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ANNALS OF SURGERY



A MONTHLY REVIEW OF SURGICAL SCIENCE AND PRACTICE

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IN MEDICINE

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ANNALS OF SURGERY

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No. 1

ORIGINAL MEMOIRS.

END-TO-END ARTERIOVENOUS ANGEIORRHAPHY*

BY HOWARD LILIENTHAL, M.D.,

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ABOUT a year ago, on learning of the work of Carrel and Guthrie of Chicago, with their remarkable and interesting experiments in angeio-anastomosis, the idea occurred to me that in a case of impending gangrene of an extremity, due to interference with the arterial blood-supply, an arrest of the necrotic process might be possible by diverting the arterial current into the veins. The conditions in which I judged that an experiment of this kind would be justified were the following: (1) Threatened gangrene due to embolism; (2) Threatened gangrene due to thrombosed aneurism; (3) Threatened gangrene due to traumatism, with great destruction of arterial tissue; (4) Malignant neoplasm involving important arteries (so that extirpation would threaten the vitality of the part; (5) Angiosclerotic gangrene.

In Mt. Sinai Hospital the cases of gangrene due to angiosclerosis far outnumber those due to all the other causes combined; so it seemed to me that my first case

*Read before the New York Surgical Society, November 14, 1906.

would probably be drawn from this class. To be sure, it is well known that in this disease the walls of the veins as well as those of the arteries are thickened, narrowing or even closing the vascular lumen, but the changes in the venous trunks and their tributaries occur later and are apt to be less marked than those in the arteries. Having once averted the gangrene, it was my hope that by general treatment a return of the trouble might be long deferred, or possibly, even prevented.

I began looking about for a case suitable for a pioneer operation, always bearing in mind the maxim "non nocere." My prospective patient must have the disease in such a form that manifestly nothing short of a major amputation would save his life and yet the gangrene must not have progressed so far that a re-establishment of the circulation might not save the remainder of the limb. Several patients with angeiosclerotic gangrene presented themselves at the hospital, but before consent could be obtained amputation became necessary. Then, in April, 1906, a young man was admitted who appeared to be a promising subject. During the time of the preliminary treatment, before angeio-anastomosis had been decided upon, I was fortunate enough to meet Dr. Carrel, who called upon me at the hospital, and I then had the privilege of hearing an accurate description of the operative technique from his lips. This proved to be of inestimable value.

The patient, W. W., entered one of my wards on April 26, 1906. He was twenty years of age, a native of Russia, and a salesman by occupation. With the exception of a chronic gonorrhoea of six years' duration, his history was unimportant up to the time of his vascular trouble, the symptoms of which began several months before I saw him. There was pain and burning in the calves of the legs, gradually increasing in severity until walking became impossible. Two months before admission a painful ulcer developed on the dorsum of the left great toe, the pain extending to the other toes and finally to the entire leg and thigh up to the groin. Another ulcer now appeared on the heel, with dusky red patches on the front of the ankle.

The physical examination was negative as to eyes, ears, nose, mouth, pharynx, glands, lungs, heart, radial pulses, liver, spleen, abdomen and rectum. Slight mucous chronic urethral discharge. General condition was good in spite of a rather marked anæmia. On the inner side of the terminal phalanx of the left great toe there was an ulcer larger than a thumbnail, its outline sharply defined, its edges raised and in part undermined, its floor covered by sloughy granulations discharging thin serous fluid. At the apex of the left heel was a similar ulcer, slightly larger than the one on the toe, its base gangrenous and black. Dusky patches on the point of breaking down were seen on the dorsum of the foot near the ankle. These ulcers and their neighborhood were intensely painful and extremely tender to the slightest touch. The left dorsalis pedis artery could not be felt nor could the left popliteal. Pulsation at the femoral was very faint. The right dorsalis pedis and femoral pulsated normally. The diagnosis of arteriosclerotic gangrene was made and treatment begun with the administration by mouth of glonoin, iodide of potassium, and with mercury by inunction, in the hope that there might be an underlying syphilitic element, even in the absence of its history. On May 16 Dr. B. Sachs saw the patient and concurred in the diagnosis.

In spite of treatment the disease continued to progress, the ulcers became larger, the foot dusky and the threatening area on the dorsum exulcerated. A few inflammatory glands could be felt in the left groin. The general condition of the patient greatly deteriorated and he and his family at length realizing that probably nothing short of amputation could be of avail, consented to a preliminary operation on the blood-vessels as a forlorn hope. It was my intention to anastomose the upper end of the severed popliteal artery with the lower end of the severed popliteal vein, closing by ligation the proximal end of the vein and, if necessary, the distal end of the artery.

On June 2, under gas and ether, I made an incision only to find that the popliteal artery was absolutely obliterated and also its continuation upward as far as could be ascertained through a seven-inch incision. The operation was abandoned and the wound closed by suture.

Four days later, June 6, the operation was performed upon the vessels in Scarpa's triangle. Carrel advises the employment

of extremely fine milliner's needles and silk. In his experiments upon animals he uses needles as fine as No. 16, the eye of which is almost microscopic in size. The mere threading of these needles is no easy task. The finest needle I was able to procure was No. 12, and with this I used white 000 silk. The needles were sterilized by boiling in the usual way, the silk by heating it in the sterilizer with vaseline. This silk is put into the vaseline *dry*, so that when the proper degree of heat is reached the entire texture of the thread becomes impregnated with the fat. The needles were threaded and ready before the operation began. In this work a needle holder cannot well be used, and a thimble is necessary in operating upon the thick walls of the larger vessels. A supply of thin tape or "bobbin" was sterilized and ready to be used as temporary ligatures which were not to be tied but held in position by small artery forceps or a spring clamp (*serre fine*). No Esmarch's bandage or other general constrictor should be used. Every necessary adjunct to the most perfect asepsis was employed, but no chemical antiseptics were permitted about the wound.

A four-inch incision crossing Poupart's ligament and running approximately in the line of the femoral vessels exposed these structures to view. A few femoral and inguinal lymph nodes, somewhat enlarged because of the infection in the foot, had to be removed. The exposure of the parts was easy and was very perfect. It was then observed that pulsation of the femoral artery existed only in the uppermost portion of that vessel, so that the anastomosis would have to be made with the upper portion of the vein, above the saphenous tributary. The return flow of the circulation in any event could hardly be through the obliterated arteries, which had remained closed even against the systolic pressure of the left ventricle, but it was hoped that blood for tissue nutrition would be carried through the venous capillaries and that it would find its way back through the gluteal, obturator and other veins, as I had observed in cases of thrombosis of the femoral or even of the external iliac vein.

The vessels were laid completely bare for about two inches and femoral pulsation was controlled by a tape ligature clamped around the external iliac artery. A loosely knotted piece of catgut was also placed around this artery to be used in case of the accidental slipping of the tape. The vein was now perma-

nently ligated at the same level as the temporary arterial ligature, and was temporarily ligated below. My object was to allow for the contraction of the severed vessels, so as to avoid tension at the proposed anastomosis. The artery was then severed about a centimeter below the point of intended anastomosis, and the vein about the same distance above it. After section it was found that this precaution had been a wise one, the mouths of the vessels being easily brought together. There was no hemorrhage. Each vessel had been cut across so as to form a stump of about 2 cm. in length, and the lumen of each of these stumps, especially that of the vein, was carefully emptied of residual blood by gentle manipulation of the vessel walls, and was then filled with sterile vaseline as advised by Carrel.

The vascular suture was performed as follows: A stitch was passed and tied, fastening the two mouths together. At a distance of one-third of the circumference from this first suture, another "anchor" suture was passed, and then a third, so that the sutures marked the angles of an equilateral triangle within the circle of the vascular lumen. The ends of the sutures were left long to permit their being used as retractors. Each stitch was passed directly through all the coats of the vessels in such a manner as to avoid the *turning in* of the walls, but rather to evert them ever so slightly to insure the contact of the intimas. By traction upon the anchor sutures, two at a time, the contiguous parts of the vascular walls were rendered straight and parallel. A running suture was passed along each side of the triangle and was tied to the anchor suture as soon as the angles were reached, so as not to break the continuity of the junction. By careful handling of the anchor sutures the vessels (vein and artery) were rotated around the longitudinal axis, bringing within easy reach that side of the triangle which was being sutured. The previous thorough dissection rendered this very easy. Just before the last running suture was tied to its anchor the vessels were emptied of vaseline by gentle manipulation. The final knot being tied, the tape compressing the femoral artery was removed, and at once the pulsating current was established from artery to vein without the suspicion of leakage. Pulsation was marked in the visible part of the femoral vein and could be felt, though intermittently and with some difficulty in the external saphenous. Carrel states that in the larger vessels of

dogs it takes about 20 minutes for the arterial blood to force the venous valves. In this case no pulsation of any of the veins of the foot was noted, but from the ulcers, which at the beginning of the operation were markedly cyanotic and did not bleed, bright red blood began to exude.

Within ten minutes the foot appeared to have recovered somewhat from the intense cyanosis incident to the ligation of the femoral artery, but it never even approached the normal in color. The wound was sutured and dressed dry, the entire limb splinted and slightly flexed at the hip, and carefully covered with a thick elastic layer of non-absorbent cotton. The entire operation consumed about 50 minutes. The patient's condition at its termination was one of shock, though practically no blood had been lost. Pulse 150°, weak and irregular. This shock continued and deepened. By the next morning the pulse was hardly perceptible. Very little urine had been passed—albuminous, with hyalogramular casts—and altogether the patient's condition was such as to forbid anything excepting general stimulation, which was most energetically carried out.

Eighteen hours after the completion of the operation a distinct line of demarcation had formed, crossing the upper portion of the dorsum of the foot, thence up the sides of the leg and crossing the calf about seven or eight inches above the point of the heel. This entire area was now obviously without circulation: cold, numb and gangrenous. Above this line, however, there was fair circulation and the patient easily located a pin-prick. Pulsation could not be felt in the saphenous vein.

The profound shock was not easy of explanation. To be sure, there had been a severe disturbance of his circulatory apparatus, but this would also have been the case had I amputated. Indeed, I had intended to amputate in the event of the failure of the angeiorrhaphy, but this plan had to be abandoned because of the shock. Death occurred 31 hours after the operation, following an ante-mortem rise of temperature to 105°. It is my belief that any radical operation would probably have been followed by a fatal result, and that the death should not be ascribed to the angeiorrhaphy.

A post-mortem examination to ascertain the cause of death was most unfortunately refused, so it was possible only to secure the specimen of vein and artery taking in the anastomosis.

This showed a smooth union with an extremely soft clot in the vein—possibly formed just before death, when the circulation was at its lowest ebb. There was not the slightest hæmorrhage, bulging of the vascular walls or other indication of a giving way under the arterial pressure.

In spite of the failure of this operation we may study its various phases with profit.

In the first place, we must recollect that the condition for which it was undertaken is absolutely hopeless so far as saving the limb is concerned. Amputation either well below the knee or at mid thigh is the usual form of successful treatment, the osteoplastic operation having yielded in my experience the best results. Yet, sloughing of the flaps with re-amputation is common enough and the post-operative mortality due to the general vascular disease is high.

In the experiments of Carrel, the subjects being healthy animals, a complete reversal of the circulation of the extremity was possible, but in cases of arteriosclerotic gangrene the most that could be hoped for would be the carrying of arterial blood for tissue nourishment through the less diseased vessels, the veins, and back again through other veins—return flow through the diseased and obliterated arteries being obviously out of the question. Actual experiment alone could demonstrate the practicability of this operation, and since in the above case the anastomosis had to be made so high in the main vascular trunks, the matter has not been decided. Had it been possible to work with the popliteal vessels, as originally planned, more light would have been thrown upon this important point.

In threatened gangrene due to embolism of arteries distal to a main trunk, the promise of success seems to me good. For example, in embolism of the popliteal artery, end-to-end anastomosis of superficial femoral artery with the saphenous vein might re-establish a circulation in the affected part, averting the necrosis. Practically nothing would be lost in the event of failure. This procedure might also

be tried in cases of thrombosed aneurism of the popliteal artery.

In destruction of a portion of the main artery by traumatism or because of the implication of its walls in an otherwise operable malignant growth, a resection of the artery with interposition of a piece of vein might be practised.

The work in angeiosclerotic gangrene should be continued, but more and more favorable cases should be selected for experiment.

One point demonstrated by this operation is that the danger of immediate traumatic aneurism following the implantation of artery into vein in the human subject, has been overestimated.

NOTE.—The case here reported is probably the first in which artery has been anastomosed with vein without a corresponding counteranastomosis of vein into artery. After my paper had been presented I learned of the case of Dr. Joshua C. Hubbard, of Boston, who had operated for gangrene about one month before my operation, and who had attempted to accomplish complete reversal of the circulation according to Carrel's suggestion, but without employing his methods. Dr. Hubbard was fortunate enough to secure an operative recovery, though without curing the gangrene. The limb had to be amputated. His case was published in the *ANNALS OF SURGERY* for October, 1906.

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ROTARY DISLOCATIONS OF THE ATLAS.

BY EDRED M. CORNER, M.B., F.R.C.S.,

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IN this paper there will be brought to notice a dislocation which with the modern improvements of skiagraphy will be found to be of infinitely more frequent occurrence than it has been in the past. Moreover, being by no means necessarily fatal, it was previously overlooked; so that now more and more recoveries will be recognized. There is a minor degree of this dislocation, a subluxation (which will form the matter of another paper*) which will be found to be still more frequent than the complete displacement.

As anatomists have paid very little attention to the atlanto-axial joints, excluding that between the odontoid process and the atlas, it is desirable that a few words be said about them. For practical purposes the joint surfaces may be described as plane and the atlas be said to glide upon the axis. The articular surfaces are not horizontal but are directed downwards and outwards on either side. They are also directed slightly forwards. Thus the atlas rests upon two oppositely inclined planes of the axis. In order to allow for the gliding movements of these joints the ligaments are lax and loose.† In consequence, our heads have to be held firm by muscular effort and not by any other means. If this tonic muscular action is abolished the ligaments allow the head to rotate 30 degrees either side of the middle line. Any violence acting at such a time has what may be termed a "flying start" before it meets any resistance. These joints are peculiar in the whole spine for their adaptation to give a large extent of rotatory

*Transactions, Clinical Society of London, 1906.

† American Journal of Medical Sciences, 1907.

movement; with the result that when any violence is applied obliquely to the head or the spine, these horizontal atlanto-axial joints will suffer the most severely. In spite of this special liability to injury, no surgical study has been made of these joints. In this communication an attempt has been made to remedy this defect and to direct attention to a dislocation which is a great deal more frequent than is thought and is by no means necessarily fatal, so that it

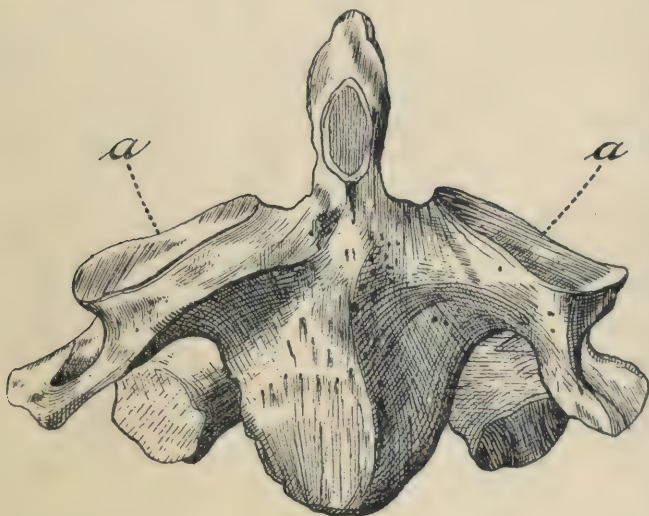


FIG. 1.—Front view of the axis vertebra, to show the outward, downward and forward inclinations of the superior articular facets (*a, a*).

is far more commonly overlooked than discovered. The author reports two new cases.

Twenty examples of rotatory dislocation of the atlas have been collected. Two belong to the author, and have not been fully reported as yet, the other eighteen have been gathered from the literature. No museum in the British Isles^{*} has a specimen, except that of St. Thomas' Hospital Medical School, London.*

*The same museum is unique in possessing an example of unilateral rotatory dislocation of the axis on the third cervical vertebra. Specimen 192.

It has been decided to report these in two classes—cases in which the injury was confirmed post mortem, and cases which recovered. The author's cases are reported in their proper classes.

Examples of the first class are subdivided into those with the rotatory dislocation alone and those in which the dislocation was complicated by a fracture. There is only



FIG. 2.—Showing anterior displacement of the right side of the atlas (unshaded), on the axis (shaded). The dislocation is only represented as incomplete in the diagram. X indicates the odontoid process and *a, a* the superior articular facets of the axis.

one possible case in the first category, rotatory dislocations being almost always complicated by other injuries. This would suggest that cases of uncomplicated unilateral dislocation recover. In this case, Buisson's, it is not quite clear if there really was a dislocation between the atlas and the axis, as well as between the atlas and the occiput. Buisson's case can be doubtfully included in this paper. In this dislocation the vertebral artery of the dislocated

side must run a great risk of being torn. Dupont alone has recorded its rupture.

There is only one possible example of a fatal case of rotatory dislocation of the atlas without other injury, which was recorded by Buisson in 1852. The description is not perfect and it is not clear if the atlas was dislocated from the axis, though such is inferred.

I. ROTATORY DISLOCATION OF THE ATLAS. BUISSON. (*Bulletin de l'Academie de Medicine de Paris*, 1852-53, xviii, 102).—A youth, aged 16, was reaching under a cart which was supported by a stake; disturbing the prop, the cart fell on him. Besides the injury to the neck there was a fracture of the right leg. Death was immediate.

Post mortem.—The muscles of the neck were badly bruised, particularly on the right side. The atlas, especially on the right lateral mass, was carried forward, its articular facet being in front of the condyle, which had slipped back; its articular surface was entirely separated from that of the atlas. The ligaments of the condyle which kept it in position, with the articular process of the atlas, were torn from left to right. The occipito-odontoid ligament on the right side was torn off the condyle. The displacement narrowed the spinal canal by half the channel of the foramen magnum.

In eight cases the lesion has been confirmed by an autopsy and was found to be complicated by other injuries; in six the odontoid process of the axis was broken, in one the atlas was broken, in another there was a lateral fracture of the axis as well (Corner's case), and in another the fifth, sixth, and seventh cervical vertebræ were broken. In seven cases the lesion was apparently unilateral, and in one bilateral. As the atlanto-axial joints allow considerable movement without any dislocation, it is often very difficult to decide whether the dislocation is bilateral or unilateral. This difficulty is accentuated by the fact that in some of the unilateral dislocations there is a partial dislocation of the joint of the other side.

Of these fatal cases, in only two did death follow soon after the accident; one in a "few hours" and the other in twenty hours. In the other six, death resulted after periods ranging from twenty-three days to many years,—a very significant fact, as it shows that these injuries need not be

fatal and, when in the living, they are easily overlooked. Gibson's case died on the twenty-third day, Cortes' in the eleventh week, Bernstein's on the one hundred and first day, Lambotte's after fourteen months, whilst Broca's and Corner's were found accidentally after death, many years after the injury.

The absence and onset of paralytic symptoms is also very noteworthy. Neglecting the two rapidly fatal cases, David's and Dupont's, none of the cases presented any paralysis, etc.,—*i.e.* spinal cord symptoms—at first. In Broca's and Corner's cases they never occurred at all. Gibson's case died suddenly on the twenty-third day from a sudden increase of the dislocation, due to injudicious movements, without ever having had any paralytic symptoms. Cortes' case developed spinal symptoms only at the beginning of the tenth week after the accident; Bernstein's on the seventy-first day; Lambotte's after a year.

The absence of spinal symptoms in so many cases points to the ease with which the injury may be overlooked. The sudden death of Gibson's case shows the penalty that may be paid for overlooking it, whilst Cortes', Bernstein's and Lambotte's cases show that a guarded prognosis should be given for some time after the accident, because of the onset of myelitis.

II. BILATERAL ROTATORY DISLOCATION OF THE ATLAS, WITH FRACTURE OF THE ODONTOID PROCESS.—Broca, in the *Bulletin de la Société de Chirurgie* (1863, 3rd series, 549), reports that on autopsy in an old man who died of an urinary disorder, the occipital foramen was found nearly obliterated. The specimen showed a dislocation of the atlas on the axis, with fracture of the odontoid process. It was a lateral displacement with a certain degree of rotation. During life the man had carried his head a little obliquely and the neck stiffly.

III. UNILATERAL ROTATORY DISLOCATION OF THE ATLAS, WITH FRACTURE OF THE ODONTOID PROCESS. BERNSTEIN. (*Deutsche Zeitschrift für Chirurgie*, lxx, 174; *Centralblatt für Chirurgie*, No. 4, iii).—A man, 18 years of age, fell from a step of a carriage, receiving a blow on the left side of his neck. His head had a twist of 40 degrees to the left. Up to the seventy-first day of his illness he had no spinal symptoms. Paralysis then began in the right arm, involving successively the right leg, left arm, left leg, bladder, rectum, and diaphragm. Death on the 101st day after the accident.

Post mortem.—Fracture of the base of the odontoid process with callus formation which led to the compression of the cord. Forward rotatory displacement of the atlas, the right side being displaced forwards on the axis. The left side was in its proper place.

IV. UNILATERAL ROTATORY DISLOCATION OF THE ATLAS, WITH FRACTURE OF THE ATLAS AND AXIS. CORNER. (*St. Thomas' Hospital Museum Catalogue*, 187).—Unfortunately this remarkable case has no clinical history; but, fortunately, the subject of the injury lived and was not paralyzed, as is evidenced by the signs of sound repair about the fracture. As a result, the bones bear marks which have been engraved upon them by the movements of the neck subsequent to the healing of the fracture. These tell their tale, allowing us to ascertain some of the results of the injury. The specimen consists of part of the occipital bone and the atlas, the axis being wanting. Luckily the atlas bears upon it unmistakeable signs of the condition of the axis.

The occipital bone is ankylosed on both sides to the atlas. It is impossible to say whether there has or has not been any fracture of the occipital condyles.

The atlas is much misshapen in consequence of fractures, which have been completely repaired by bone, ankylosis to the occiput accompanying that repair. A fracture has taken place at the apex of the posterior arch and has been united by fibrous tissue, not by bone. In the region of the right lateral mass there has been a further injury. This fracture has apparently been comminuted, accounting for the great deformity of the lateral mass. The damage to the atlas has been confined to the right side, a point which indicates that the head at the moment of the accident was on the right side, so that all the violence was transmitted to the right condyle. The ankylosis of the corresponding occipito-atlantal joint was a direct consequence of the injury; the ankylosis of the joint of the opposite side was secondary and a result of that on the right.

The fractures of the atlas are two in number. The primary one was in all probability the comminuted one of the right lateral mass, owing to the right occipital condyle being impacted on to it. On account of the mechanical disposition of the articular surfaces, the same impact would drive the lateral mass outward and lead to a secondary snapping of the posterior arch, as in the breaking of a bird's "merrythought."

The condition and disposition of the axis can only be inferred by the articular facets on the under surface of the atlas. The left articular facet is markedly smaller than is normal and has been covered with cartilage in the recent state. The facet for the odontoid process presents many peculiarities. Instead of being more or less circular, it is much elongated from above downwards, the process articulating with the left side of the foramen magnum. Its vertical or long axis is oblique and quite out of harmony with the left atlanto-axial facet just described. Therefore, between these two facets there must have been a fracture. Under the large deformed right lateral mass of the atlas, continuous with the facet for the odontoid process just mentioned, is a new facet which must have been a joint between the atlas and the body of the axis. To the right of this

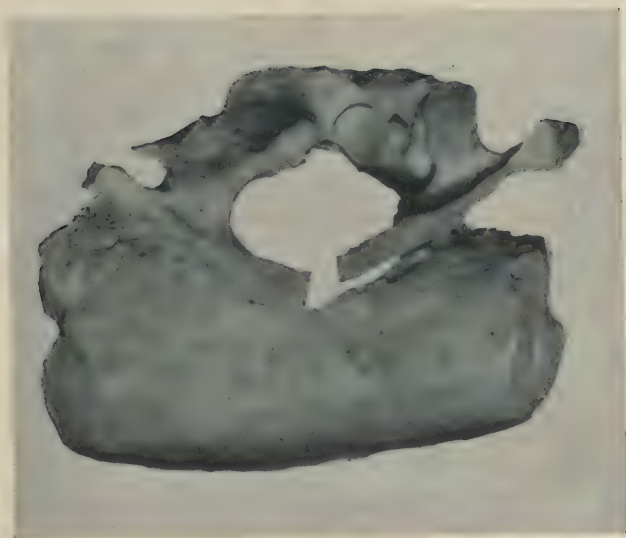


FIG. 3.—Photograph of specimen of Case IV.

impression there is the place where the right articular facet for the axis should be. This can be traced in outline, but the surface has evidently *not* been covered with cartilage. There must have been a dislocation here as there has been ankylosis of the atlanto-axoid joints. To sum up, the articular surfaces on the under part of the atlas indicate that there had been a lateral fracture of the left side of the axis, involving the outer part of the superior articular facet, and a rotatory dislocation of the rest of this joint and also of that of the other side. That is to say, there has been a lateral fracture with rotatory dislocation of the axis without causing death.

The dislocation of the axis has resulted in the displacement of the right fragment of the atlas backwards and slightly inwards; and the left

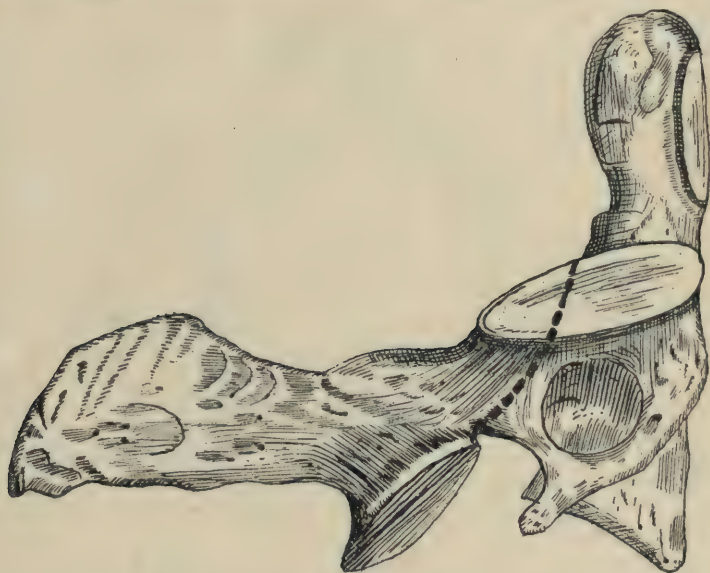


FIG. 4.—Side view of an axis vertebra. The dotted line indicates the site of a *lateral fracture*. See American Journal of Medical Sciences, 1907.

fragment forwards and outwards. There is also some rotation of the vertebræ on their transverse axis.

A few words must be said as to the possibility of a fracture of the base of the odontoid process having occurred.* This seems not an unlikely thing when the presence of the unilateral dislocation of the atlas is taken into account. But there are several reasons to make us think otherwise. In the first place the process has worn for itself a well marked facet, which a broken off process would be hardly expected to do. Such might occur if the fragments united with bone. But fibrous union alone is

*Transactions of the Medical and Chirurgical Society, London, 1907.

known to occur in 97 per cent. when this fracture is required. Also, the articular facet for the odontoid process is continuous with the new facet for the body of the axis, as has been pointed out above, which suggests continuity of bony structure, and therefore no fracture. Apparently, the process has preserved its proper anatomical relationship with the body of the axis, as is shown by the facets. Moreover, the integrity of the process would have a great deal to do with the prevention of instantaneous death, for by locking between the anterior arch of the atlas and the transverse ligament, it will limit the displacement of the axis and prevent damage to the spinal cord and its membranes. In this we may compare Lowson's case*

A similar question of fracture of the odontoid process was raised

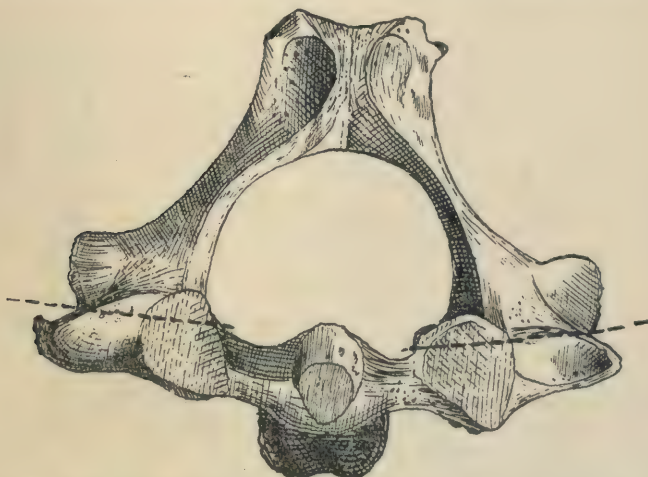


FIG. 5.—View of the atlas vertebra from above. The dotted lines indicate the situations of lateral fractures.

about the author's other case (XIII) and, likewise, it was decided not to be present.

V. UNILATERAL ROTATORY DISLOCATION OF THE ATLAS, WITH FRACTURE OF THE ODONTOID PROCESS. CORTES. (Malgaigne's "Fractures," II, 329).—A youth, aged 15, was thrown to the ground and received several blows on his head and neck. He was quite well for nine weeks; then he lost the use of his limbs, and died in the eleventh week.

Post mortem.—It was found that the atlas was dislocated forwards with the right side more advanced than the left. The odontoid process was fractured across its base and lay almost horizontal.

VI. UNILATERAL ROTATORY DISLOCATION OF THE ATLAS, WITH FRACTURE OF THE 5TH, 6TH, AND 7TH CERVICAL VERTEBRÆ. DAVID. (*Bulletin de la Société Anatomique de Paris*, 1888, lxiii, 910).—A man, aged 26,

* Medico-Chirurgical Transactions, 1875.

was caught by a buffer in the upper part of the neck and thrown some distance. When seen the neck was very painful. There was a suboccipital depression extending as far down as the spinous process of the axis; a corresponding projection could be felt in the pharynx. There was paralysis of all four limbs. Death 20 hours after the accident.

Post mortem.—There was dislocation forwards of the atlas upon the axis, to the left side, with compression of the cord. There was also a vertical fracture of the posterior and middle parts of the body of the fifth cervical vertebra. The sixth and the seventh vertebrae were likewise fractured.

VII. UNILATERAL ROTATORY DISLOCATION OF THE ATLAS, WITH FRACTURE OF THE ODONTOID PROCESS. DUPONT. (*Bulletin de la Société Médicale de la Suisse*, 1876, x, 65).—A man in delirium tremens leapt from the fourth story of a building. Death resulted in a few hours. Upon post-mortem examination there was considerable separation between the atlas and the axis. The latter was luxated backwards and pivoted on its left atlanto-axial joint, which remained in its proper place. The odontoid process was fractured at its base, but owing to the fact that the ligaments remained intact there was no displacement of the process. The vertebral artery was also ruptured.

VIII. UNILATERAL ROTATORY DISLOCATION OF THE ATLAS, WITH FRACTURE OF THE ODONTOID PROCESS. GIBSON. (*Lancet*, 1885. ii. 429).—A man, aged 58, rolled down a bank and lay there all night. Upon rising, he was too unsteady to walk and had to be assisted home. His head was very much set forward, the chin resting on the sternum. It was held rigidly in this position. He said that he was suffering from a pain of a burning character. There was a great prominence at the back of the neck just below the occiput. The highest cervical spine was two inches from the occiput. A diagnosis was made of a displacement between the atlas and axis. There was no paralysis. He was laid on the bed and steady traction applied to the head, when the dislocation suddenly reduced with a snap. Crepitus was also felt, indicating the presence of a fracture. The prominence of the spines disappeared and the head went naturally into line with the body. A week later he was seized with abdominal pain after eating some bread and butter. Whereupon, in spite of efforts to prevent him, he started up and almost immediately fell back dead.

Post mortem.—Considerable separation was found between the atlas and axis. The cord was tightly stretched and pulled against the anterior wall of the canal. There was no damage to the cord. The odontoid process and part of the body of the axis was broken off and remained in its situation against the arch of the atlas, the transverse and other ligaments being intact.

Death after twenty-three days.

IX. UNILATERAL DISLOCATION OF THE ATLAS, WITH FRACTURE OF THE ODONTOID PROCESS. LAMBOTTE. (*Annales et Bulletin de la Société de Médecine d'Anvers*, 189, lvi, 031-133).—The fracture was produced by a simple movement of extension of the head, while the young woman

was sewing. Afterwards, she suffered from pains in the head and a stiff neck. A year later she began to suffer from paralysis in the upper limbs, imperfect anæsthesia, exaggerated reflexes, etc. Death occurred about fourteen months after the injury.

Post mortem.—The odontoid process was found to be fractured across its base transversely, and repaired by some fibrous tissue. The atlas was dislocated forwards on the right side only. The transverse and check ligaments were intact.

Having gleaned what knowledge was possible from the records of fatal cases of rotatory dislocation of the atlas, it now remains to apply that knowledge to reported cases of recovery from that injury. Ten of these have been collected,—the earliest being Bayard's, in 1870, and the latest the author's, in 1905. Of these ten, only one presented any spinal symptoms—the second case of Lannelongue; but the description is insufficient to enable it to be said to what extent. In only one is the odontoid process known to have been broken—Bayard's case—which is striking when compared with the fact that that fracture was found in six out of eight cases in which there was a post-mortem examination.*

In Billot and Picque's case, as in the author's, the patient had considerable difficulty in swallowing. In my case the patient had great difficulty in opening his jaw as well.

In the instance recorded by Uhde, Hagemann and Boettger, the right hypoglossal nerve was permanently paralyzed. It is hardly conceivable that this nerve could have been stretched or ruptured by the dislocated atlas. The probable key to the explanation is to be found in a case of Sir James Paget's which was shown before the Clinical Society.† The hypoglossal nerve was injured in a case of fracture of the posterior fossa of the base of the skull. The violence which produced the dislocation of the atlas in Uhde, Hagemann and Boettger's case would have been prone to fracture the posterior part of the base of the skull. It would appear that this instance is an example with coin-

*Transactions of the Medico-Chirurgical Society, 1907.

†Clinical Society's Transactions, iii, p. 183.

cidence of the injuries. The difficulty in swallowing, noticed by Billot, Picque and the author, was probably due to the dislocation causing some injury to the first or second cervical nerves, so rendering the pharyngeal plexus inefficient. Sir Thomas Barlow has published a case of hemiatrophy of the tongue with paralysis of the soft palate, following injury to the upper cervical spine and (?) to the rim of the foramen magnum, in the Transactions of the Clinical Society of London, 1889, xxii, pp. 322-327. He regards the symptoms to have arisen in consequence of cicatrization in the healing of the fracture in the occipital bone. The cases of Sir James Paget and Sir Thomas Barlow, in all probability offer the correct explanation of the paralysis of the right hypoglossal nerve observed by Uhde, Hagemann and Boettger in the case which they have recorded (XIX).

X. UNILATERAL ROTATORY DISLOCATION OF THE ATLAS. BACON. (*University Medical Magazine*, 1891, iii, 182).—A man, aged 22, fell down sixteen steps, striking his head. He was conscious and able to walk. His head was slightly flexed and turned to the right. It could not be moved.

On examination, the spinous process of the axis was turned to the left and upwards for a quarter of an inch. In the pharynx, corresponding to the body of the axis, was found a marked projection. There was no paralysis or anæsthesia.

The man got quite well and the movements of his head returned to a limited extent.

XI. FRACTURE OF THE ODONTOID PROCESS AND ROTATORY DISLOCATION OF THE ATLAS. BAYARD. (*Boston Medical and Surgical Journal*, 1870, N. S., v. xliii).—A girl, aged 6, fell, a month previously, from a pile of boards about five feet high, striking her head and neck. Afterwards she could not move her head without pain. She was treated for neuralgic pains in the neck.

The head was inclined forward and to the right; she supported it with her hand under her chin. Any attempt to rotate or move it caused great pain. No irregularity could be found in the vertebræ of the neck. She was ordered to be kept on her back as much as possible. Nine months later she walked well, but still supported her head. The head now rested on the right shoulder and the neck was much altered in shape, the irregularity giving the impression that there was a "partial luxation of the atlas and axis." She wore an apparatus to support her head for a year, at the end of which she could hold her head up and even rotate it consider-

ably. Three years after the accident she had an abscess in the neck from which was discharged the separated odontoid process.

XII. UNILATERAL ROTATORY DISLOCATION OF THE ATLAS. BILLOT and PICQUE. (*Bull. et Mem. de la Soc. de Chir. de Paris*, 1900, xxvi, 23).—A man, aged 21, fell upon his head a distance of three and one-half metres, without losing consciousness, got up and walked a hundred metres. He complained of violent pain at the nape of his neck, great difficulty in swallowing and on movement of his head. There was no paralysis or anæsthesia. The pain in the neck disappeared in about fifteen days; the dysphagia lasting a little longer. At the end of three weeks he was sent back to his regiment with only a stiff neck. The face was turned a little to the right. The upper part of the neck was deformed; a little out of the median line a prominence was visible. The spinous process of the axis was deviated a fingerbreadth to the right. The movements of flexion and extension were very limited and rotation was very incomplete. There was a protuberance in the right side of the pharynx. The case was called one of dislocation to the right of the atlas by rotation of the vertebra upon its body, without fracture of the odontoid process.

Recovery without any serious effects.

XIII. UNILATERAL ROTARY DISLOCATION OF THE ATLAS ON THE AXIS, WITH FRACTURE OF THE ANTERIOR ARCH OF THE ATLAS. NO PARALYTIC SYMPTOMS. RECOVERY. (CORNER.) (*Clinical Society's Transactions*, London, 1905.) Shown at the Clinical Society of London, February 24, 1905.—J. L., aged 21, fell from off a horse, striking his forehead. Beyond making him "see stars," he was not much hurt. He got up and rode his horse home. He came to St. Thomas' Hospital complaining of a stiff and somewhat painful neck, and was treated with liniment and rubbing; but as he was no better at the end of a fortnight he was admitted.

Examination.—The patient carries his head a little flexed and turned to the right. Movements are limited and the neck is stiff. The left transverse process of the atlas is easily palpable between the mastoid process and the angle of the jaw. On the right side it cannot be felt, the examining finger sinking into a groove. Further palpation gives the impression that the transverse process is displaced backwards. There must be a dislocation of the right atlanto-axial joint. On the right side of the neck, below the point just mentioned, there is felt a prominence of the middle of cervical vertebræ, which shows that there has been some accompanying rotation of the vertebræ below the dislocation. After a few minutes' standing the man became fatigued.



FIG. 6.—Photograph of J. L., showing his chin turned towards his right shoulder.

An examination on a later day confirmed the above observations and it was further remarked that he could rotate his head to the right or injured side, but not to the left or uninjured side. A further observation was that he had difficulty in opening his mouth and his articulation was indistinct. There was no difficulty in swallowing such food as the restricted movements of his jaws allow him to take. He was never able during his stay in hospital to open his mouth sufficiently to allow his pharynx to be examined by a finger. There were never any paralytic or anæsthetic symptoms.

When his pharynx was examined, after his jaws had recovered sufficiently to enable him to open his mouth, the right side of the atlas, which was displaced forward, could be felt as a prominence on the posterior wall.

The skiagraph shows the unilateral dislocation of the atlas from the fracture of the anterior arch of the atlas. It is not clear whether the odontoid process is broken, but it was generally thought at the meeting (Clinical Society*) to be intact.

XIV. UNILATERAL ROTATORY DISLOCATION OF THE ATLAS. HESSE, (*Beitrage zur klin. Chir.*, 1895, xiii, 93).—A man fell from a cherry tree striking on his head. His head was turned to one side and his neck was stiff and immovable. He was never fully unconscious and had a peculiar sensation about his arms and legs. There was no paralysis. The head was replaced when under an anæsthetic. Professor Socin diagnosed a "torsion luxation of the atlas." The recovery presented nothing noteworthy.

Described as an example of the rotation luxation of Uhde, Hagemann and Boettger.

XV. TWO CASES OF UNILATERAL ROTATORY DISLOCATION OF THE ATLAS. LANNELONGUE. (*Compt. Rend. de l'Academie de Science*, Paris, 1904, cxxxix, 495-6.) CASE I.—A child, 8 to 9 years of age, hung himself accidentally whilst playing. There was an unilateral dislocation of the atlas on the axis, which was reduced and the child made an uninterrupted recovery.

XVI. CASE II.—An officer was thrown from his horse and suffered from a similar dislocation of the atlas on the axis. He had four-limbed paralysis. Reduction was followed by recovery, though it is not stated whether the paralysis passed off completely.

XVII. UNILATERAL ROTATORY DISLOCATION OF THE ATLAS. LEGG. (*Lancet*, 1893, ii, 1382).—A lad (schoolboy) tumbled over another boy in the playground and, turning over, caught the back of his head in an angle formed by the trunk of a tree and the ground.

* Clinical Society's Transactions (London), xxxviii, p. 228; also in the next volume.

The head remained twisted to the left and he was quite incapable of rotation, all attempts at it causing great pain. The chin was somewhat raised so that he could not see his toes. Pressure over the lower cervical spinous processes caused no pain and disclosed no irregularity, but when applied to transverse process of the atlas, especially on the right side, it caused great pain. The diagnosis was "a probable rotatory dislocation or hyper-rotation of the atlas upon the axis." The dislocation was reduced by exerting traction on the head with counter-extension on the trunk, a click being heard at the moment of reposition. Recovery uneventful.

XVIII. UNILATERAL ROTATORY DISLOCATION OF THE ATLAS. PANAS. (*L'Anjou Médical*, 1898, 41).—A case of luxation of the atlas and axis was described with special reference to the symptoms of amblyopia. The man fell whilst carrying things. There was right torticollis. Not much space is given to the dislocation itself. The sight of the right eye was lost some days after the accident. There is a long account of the possible pathology of the ophthalmic symptoms. Recovery from the injury. There never were any paralytic signs.

Mr. J. B. Lawford, Ophthalmic Surgeon to St. Thomas' Hospital, to whom I showed this paper, thought Panas' explanation insufficient. M. Panas is the only observer to mention eye symptoms in these cases.

XIX. ROTATORY DISLOCATION OF THE ATLAS. UHDE, HAGEMANN AND BOETTGER. (*Archiv für klinische, Chirurgie*, 1878, xxii, 217).—A man, aged 34, fell thirty feet. He sustained a comminuted fracture of the right humerus. There was also pain and tenderness with immobility of the neck. The head was carried bent over to the right, the chin being directed to the left. Moreover, the head was flexed, thus being twisted on all three axes. On the right side the transverse process of the atlas could not be felt in its proper position and the finger sunk deeply into the neck in this place. It was ascertained that the right transverse process was displaced forwards. The corresponding process on the left side is asserted to be displaced backwards, but it is not made clear upon what authority the statement is made. There was a permanent paralysis of the right hypoglossal nerve. There were no spinal symptoms. The deformity was restored by extension and the man recovered. The case is called one of *luxatio atlantis violenta*, with dislocation of the atlanto-axial joints.

It now remains to draw in brief form the features by means of which rotatory dislocations of the atlas may be observed clinically, so that the lesion may be recognized as an important and not infrequent injury amongst instances of sprained necks.

To begin with, there is the history of the accident, in which the violence is commonly applied to the front and top of the head. There are no symptoms of paralysis or anæsthesia, neither has there been recorded a case of spinal concussion.* The neck is painful to touch and to move. It is stiff and capable of little movement. The position of the head is very characteristic. It is flexed and turned a little to one side, usually the right. In more severe examples the head is bent towards one shoulder so that the chin points to the other side. In the latter case, it is probable that the head cannot be moved. In the former and less severe varieties, the head can be rotated more to the side to which it is directed than to the other.

The side to which the chin is directed is that on which the transverse process of the atlas is rotated backwards. The side to which the head cannot be rotated is that which is, or is only partially, dislocated. For the joint of the side to which the head is rotated is fixed, forming the centre of the curve along which the other joint moves. For example, in turning the head to the right, the right atlanto-axial joint is fixed and the left moves, and vice versa. If the left side is dislocated, the head can only rotate a little to the right, as the left joint does not exist. It can be rotated a little to the left, since the right joint can move, but only a little, as the forwardly dislocated left joint is the fixed point and will not permit more. By means of the rotatory movements present it is possible to decide whether the injury is unilateral or bilateral, but care must be taken in making observations.

Normally, the transverse process of the atlas can be felt half way between the tip of the mastoid process and the angle of the jaw. This can be felt plainly on the side from which the head is turned, unless, when the patient looks forward, it is hidden by the angle of the jaws. On the side to which the head is bent it cannot always be felt, the finger sinking deeply inward and forward into the neck;

*Lancet, ii, 1906.

the transverse process of the atlas has been displaced backwards. A similar observation must be made frequently on a sound but rotated neck; otherwise it is not easy to make. From the back, the spine of the axis, when it can be seen or felt, is deviated somewhat to the side from which the head is bent. This is not due to the fracture, but to the lateral curvature of the cervical spine, which is caused by the flexion and rotation of the head. The condition of the spine of the axis is of some interest, as sometimes it is more prominent than usual and at other times less prominent. The prominence of this spine is due to flexion and forward displacement of the head. Great prominence means much forward displacement of the head, and therefore the odontoid process is very likely to be broken.

An examination of the pharynx, preferably under chloroform, reveals two prominences, that on one side being due to the forwardly displaced transverse process, and that on the other, which is bulkier and less distinctly defined, being due to the part of the axis which has been denuded by the backward displacement of the transverse process of the atlas on that side. Attention has never been directed to these *two* points to be ascertained on examination of the pharynx.

A skiagraph of the lateral view of the head shows a forward displacement of one side of the atlas, owing to the transverse axis of that bone being oblique to the rays. It confirms the clinical observations. A most important thing is to ascertain if the odontoid process has been broken or not. If it has not, there is far less danger if a reduction of the dislocation is attempted, a proceeding which is dangerous if it is. This is not easy to make out, as the two lateral masses of the atlas when viewed from the side are normally one behind the other; in a rotatory dislocation they are seen laterally *en échelon*, obscuring the odontoid process. It is possible in most cases, especially in the recent one, to decide whether or not there has been a fracture. Later, the outlines of the bones become obscured from some

callus and inflammatory reparative formations. The integrity or otherwise of this process is extremely important to the life of the patient, as if intact it will lock between the anterior arch of the atlas and the transverse ligament. If it is broken there is little to protect the cord from an injury.

Anterior skiagraphs show nothing, and, owing to the rotation of the head and the patient's inability to open the mouth wide, a skiagraph of the odontoid process cannot be obtained.

The five points upon which to rely for a diagnosis are the *position of the head*, the *positions and fixity of the transverse processes of the atlas*, the *examination of the pharynx*, and the *skiagraph of the lateral view of the neck*. There is usually nothing which will absolutely exclude fracture of the odontoid process. If the process is broken, death may easily result from a sudden increase in the amount of the dislocation. If it is unbroken, it will lock with the anterior arch of the atlas and the transverse ligament, being a safeguard to the spinal cord. Mention has not been made of the differentiation of unilateral rotatory dislocation from an injury, to which I have lately directed the attention of the Clinical Society of London (*Transactions*, 1906 and 1907), namely, rotatory subluxation of the atlas. The distinction is difficult to make in some cases, as the complete dislocation differs from the partial only in the "quantity" of its symptoms, not in their quality. The subluxation is always reduced very easily when muscular relaxation is induced.

Treatment.—When a diagnosis has been arrived at, and the probable condition of the odontoid process ascertained, the question is whether to reduce the dislocation or not. If the accident has already happened for a fortnight to a month, or the odontoid process is thought to be intact, an anæsthetic may be given. In a number of the cases spontaneous reduction occurs when the muscles are relaxed. In others gentle traction on the head and rotation will bring about the desired result. The head can be put up in a plas-

ter of Paris collar or in wood wool and bandages, which will be succeeded in a few days by a poroplastic collar. If, on the other hand, the odontoid process is thought to be broken, keep the patient at rest in bed with the head immobilized with sand bags, and three weeks to a month later give an anæsthetic to examine the pharynx and reduce the dislocation.

Should the surgeon not reduce the dislocation, the neck is put into a poroplastic collar. Movements in the neck will return, but will be limited. Operative treatment, unless to relieve symptoms of pressure on the cord, is not likely to be of much use.

The following case has been published as an instance of rotatory dislocation of the atlas occurring in prehistoric man. It cannot be accepted as an example of this injury and may be regarded a romantic narrative.

XX. ROTATORY DISLOCATION OF THE ATLAS IN PREHISTORIC MAN. BAUDOUIN. (*Compt. Rendu Acad. de Science*, Paris, 1904, cxxxix, 494-5).—A skeleton was found in a barrow at Vendée, which had a rotatory luxation of the atlas on the axis. It was a bilateral dislocation. As the skeleton was silicated whilst it lay *in situ*, and therefore before it was disturbed, the dislocation was thought to be the cause of death. The odontoid process was not broken. M. Lannelongue and others who were present at the séance at which the paper was read, thought that the dislocation had been brought about by the head turning with its own weight after decomposition had softened and loosened the muscles and ligaments. Thus the lesion was a post-mortem change and not an ante-mortem cause of death.

OCCLUSION OF THE PORTAL VEIN DUE TO SURROUNDING INFLAMMATORY ADHESIONS.

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ON account of its rarity and surgical significance the following is of sufficient interest to be reported.

Female, age 67, family history negative.

Personal History.—Married at 17; four children; no complications. The patient has never suffered from any serious illness. During the past fifteen years she has had occasional attacks of what was thought to be indigestion; these were accompanied by gaseous eructations, slight abdominal pain, malaise and headache. There was no vomiting, no jaundice, no other disturbance. On January 1, 1900, the patient underwent a sudden and severe shock, owing to the death of her husband and daughter; after this she became very much depressed, noticeably lost flesh and became anæmic. The appetite was poor, sleep was disturbed, but there was nothing referable to any disturbance in the intestinal tract.

Present Illness.—On May 20, 1900, she was awakened early one morning by a severe pain in the right hypochondrium, which radiated towards the umbilicus and downward toward the pubis. The pain was moderately severe, somewhat paroxysmal in type and lasted for two hours, but was entirely relieved by five grains of phenacetin. There was no vomiting. Several hours later the pain returned with increased severity, but fifteen drops of the tincture of opium relieved it entirely.

According to the statement of her physician there was some rigidity of the muscles in the upper half of the right side of the abdomen, and over this area there was tenderness on pressure. There was no tumor mass to be felt. Constipation was present at the time and was complained of for some days following. There was no jaundice at any time. After this the patient lost flesh very rapidly; her appetite became poor; she suffered with constipation, alternating at intervals with attacks

of diarrhoea. There was no pain subsequently complained of, but on deep pressure in the right hypochondrium there was tenderness. Four weeks after the attack fluid was first noticed in the peritoneal cavity; this rapidly increased, the loss of flesh continued, the exhaustion became more and more marked and the constipation more obstinate.

Six weeks after the onset of the swelling—ten weeks after the attack—I first examined the patient. The abdomen was very markedly distended with fluid; respiration was distinctly interfered with; the muscle wall was everywhere soft and examination disclosed nothing but the large amount of fluid. The heart and lungs appeared normal; the temperature was normal, the pulse was 92, regular, but poor in volume. The tongue was slightly coated and the mucous membranes were pale. The face while distinctly emaciated was of a remarkably good color; there was no evidence of cachexia.

Urinalysis.—1100 cc. in 24 hours. Acid, pale straw color, specific gravity 10.22, no albumin, no sugar, no blood, no pus, a few epithelial cells, triple phosphates and urates in small quantity, no bile.

Stools: Soft, normal color, normal odor, no undigested food, no free fat.

A specimen of blood was taken, but owing to an accident the examination was not completed.

Six litres of a clear, pale straw-colored fluid were withdrawn from the abdomen. It was of a slightly reddish tint; there were no cheesy particles nor debris. Microscopic examination revealed a large number of red corpuscles; the fluid clotted readily. After removal of the fluid no change in the liver dulness could be made out, the lower border of the organ could be felt, it was smooth and regular. On deep palpation no mass could be felt, but there were tenderness and muscular rigidity. The spleen was not palpable, the dulness was not increased; neither kidney could be felt.

In a short time the fluid began to return and after five weeks three litres were withdrawn. This fluid contained no blood. Ten days afterwards the patient died.

A partial autopsy only was permitted. In the right hypochondrium a palpable mass was found as soon as the hand was inserted. This proved to be an inflammatory growth about

the size of an orange, which matted together the duodenum, the head of the pancreas, the gall-bladder and the under surface of the liver. This mass surrounded the portal vein and common duct. The duct was patent, but the portal vein was pressed upon for about three-quarters of an inch and entirely occluded; behind and before the occlusion there were definite thrombi. The gall-bladder contained about 20 cc. of a turbid fluid and three irregularly shaped gall-stones about the size of hazelnuts. The wall was very much thickened and the mucous lining roughened. The cystic and common ducts were patent. The liver was of normal size and except that it presented the appearance of chronic passive congestion there was no change. The stomach and duodenum were not opened; they were not distended. A section of the pancreas appeared to be normal. The kidneys were not examined nor was the chest opened.

While it cannot be definitely stated what was the cause of this mass, it is probable that it was due to a pericystitis, resulting from a long continued inflammation of the gall-bladder. It is possible that a perforation by one of the stones may have occurred, but there was no evidence to prove this assumption. This inflammatory mass with its subsequent cicatricial contractions had caught and finally occluded the portal vein.

The ill-defined attacks of indigestion which had been complained of for fifteen years previously were probably due to the gall-stone and inflammation of the gall-bladder. During the last attack something happened which allowed the surrounding inflammation to occur and formed the starting point of the inflammatory mass. This in turn by its occlusion of the portal vein interfered with the intestinal circulation, and caused the ascites and other symptoms noted during life.

An exploratory operation was thought of, but the extreme emaciation, anæmia and exhaustion present when I first saw the patient seemed to contraindicate any operative interference.

OBLITERATION OF THE STOMACH AS A RESULT OF GASTRIC ULCER—DUODENOSTOMY.

BY JAMES B. BULLITT, M.D.,

OF LOUISVILLE, KENTUCKY.

P. R., male, age 40, was quite well and normal up to June 15, 1901, when he had a severe pain in stomach immediately after swallowing food, which persisted until the stomach was emptied by vomiting. From that time on he had constant pain in stomach whether the organ was empty or full. There was constant vomiting. There was no blood in vomitus or stools at any time. In the summer of 1903 he entered St. Edwards' Hospital, New Albany, and came under the care of Dr. Charles P. Cook. At that time there was manifest pyloric obstruction, the stomach outlines and washings showing marked dilatation. No tumor could be palpated. The stomach was washed out daily for two weeks, preparatory to a proposed operation of gastro-enterostomy, the patient gaining 15 pounds in this time. The patient felt so much improved that he left the hospital, refusing operation.

He was again seen in August, 1905. At this time, on making efforts to wash out the stomach, it was found that the tube could not be made to enter the stomach. The patient began to have great difficulty in swallowing food. He first gave up solids and semi-solids, and was finally reduced to only a teaspoonful of liquid at a time. Vomiting of ingested matter and mucus was continuous.

He finally came to operation on November 27, 1905. For four weeks before this time he had retained practically nothing at all by stomach.

The abdomen was opened in the mid-line, between ensiform and umbilicus. The stomach was exceedingly difficult of identification. A mass, the size of a medium-sized oyster shell, was detected buried in adhesions and occupying the site where the stomach should be. This was finally identified as the stomach by passing the stomach tube by mouth, with the mass between the fingers. The tube could be felt to enter its center, its intro-

duction being attended by the discharge of about a tablespoonful of evil-smelling liquid. The cavity of the stomach seemed to grasp the tube with some firmness. The mass representing the stomach was hard and smooth rather than nodular, and, as already stated, was buried in adhesions.

The alternatives of attempting a gastrectomy in the face of the adhesions, or making an enterostomy, presented themselves. The latter was determined upon. A small slit was made in the descending portion of the duodenum, large enough to admit a small-sized stomach tube. The tube was then inserted and buried in the wall of the duodenum for about two inches; the parietal peritoneum was sutured to the intestine along this same line. The incision was closed up to the tube, which came through the incision at about its middle, being essentially the method employed by Witzel in making a gastrostomy.

The patient immediately received milk and broth through a funnel attached to the tube.

In the ten months since operation his weight was increased from 90 pounds to 130. His normal weight was 145 pounds. He eats everything, including meats, cabbage and sauerkraut. The food is taken into the mouth, chewed thoroughly until finely divided; a little coffee, tea or other liquid is then taken into the mouth, and then the whole mouth contents is directed into a funnel connected to a tube previously passed about six inches into the artificial mouth.

At first, immediately after the operation, an occasional slight diarrhoea occurred. For many months digestion and bowel function have apparently been uneventful.

There is practically no leakage from the fistula. The patient keeps a rag stopper in the opening between feedings, in order to keep the opening dilated. Otherwise, there is pain on introducing the tube. About six meals are taken daily.

For a time after operation when hunger was felt patient would occasionally try to swallow food. There would immediately be a sense of fulness and distention, evidently of the lower end of the œsophagus, and thereupon the ingested matter would be ejected. These efforts have long since been given up entirely. Every evening the gullet is washed out by taking a swallow of

water: this is immediately ejected, bringing with it a small quantity of mucus.

The condition presented in this case constituted a practical obliteration of the stomach. I think there can be no doubt that the process was one of chronic ulceration, with gradual contraction and so obliteration, attended by the formation of extensive adhesions around the stomach.

In making an enterostomy under such circumstances it is manifest that the higher up, the closer to the pylorus, the opening can be made, the better. In this case the cutting out of the stomach seems to have had no appreciable effect on the process of digestion.

In the early days of feeding, before the patient took the food into the mouth before injecting it through the tube into the duodenum, diarrhoea resulted. Since the food has been first taken into the mouth the bowel movements have been always soft and otherwise natural.

With the exception of this man's social disability, his necessity of isolating himself at feeding time, and the further necessity of more frequent feedings, he is comparatively as well off as if he had a pervious stomach. He states that the feeling of hunger is immediately relieved on receiving an injection of food.

The patient's future has been given careful consideration. Sufficient proof has been offered to cause an apprehension of cancer growth on every ulcer base, and this is certainly a possibility worthy of consideration in this man's case. As no food will come in contact with and continually pass over the sites of old ulceration, it seems reasonable to assume that the danger of ultimate cancer growth would be less in this case rather than greater.

Further operation in this case, gastrectomy with anastomosis of jejunum with oesophagus, would be extremely difficult and hazardous, owing to the stomach remnant being buried in such extensive and dense adhesions. It would probably be possible of performance. In such event

it would unquestionably be best to cut the jejunum square across, anastomosing the distal portion with the œsophagus, and implanting the proximal end in the side of the coil anastomosed with the œsophagus. The present artificial mouth could be then used advantageously for a time, and could be ultimately closed.

The patient's general condition is so good, and the outcome of such possible surgery so uncertain, that I have advised him, for the present at least, to bear the ills he has rather than risk others he knows not of.

TYPHOID WITH DOUBLE PERFORATION OF ILEUM AND PERFORATION OF GALL-BLADDER.*

INTESTINAL SUTURE. CHOLECYSTECTOMY.

BY OTTO G. T. KILIANI, M.D.,

OF NEW YORK.

Surgeon to the German Hospital.

ON July 24, 1906, a patient, H. W., forty years of age, German, single, was admitted to the medical ward of the German Hospital with the following history:

The patient was too sick to inquire into family and previous history. For four weeks past he had complained of indefinite abdominal pain, diarrhoea, drowsiness and weakness; appetite has been poor. He has not vomited, no cough, no dyspnoea, no icterus, no night-sweats, no palpitation, normal urination. Eyes and ears normal. Temperature 104.4°, pulse 116, respiration, 28.

He was a poorly nourished male; face flushed, tongue coated thickly. Lungs: slight dyspnoea; no dulness, few rales over right base, subcrepitation. Heart: borders not enlarged. Abdomen: slight rigidity, marked tenderness on right side of abdomen, especially under right costal margin; slight rigidity of muscles over liver. Liver dulness reached 2½ inches below costal margin. Spleen palpable, soft, round edge; kidneys not palpable. Extremities negative.

Diagnosis.—Typhoid fever. Examination of the urine showed that through the entire disease practically normal conditions existed, except faint traces of albumin. Diazo stayed negative throughout. A few hyaline cylinders (casts).

Examination of blood, July 24:

Polynuclears.	72 per cent.	RBC, 3,600,000.
Lymphocytes.	19 per cent.	WBC, 5,600.
Mononuclears.	4 per cent.	Hb, 75 per cent.
Eosinophiles.	0 per cent.	Widal, 1-50, negative.
Basophiles.	2 per cent.	
Transitionals.	3 per cent.	

*Read before the New York Surgical Society, October 24, 1906.

The case was accepted as suspicious of typhoid (ambulatory), and was especially carefully watched, as is the rule in the Hospital with these cases. The man had been admitted at 4 P. M. Next morning, July 25, at 2.30 A. M., about eleven hours after admission, the patient suddenly complained of extremely severe pain in the abdomen, as if he were being knifed, (*douleur à poignard*) and became extremely restless. The temperature within two hours dropped to 99.8°; the pulse also dropped from 116 to 92. The night nurse reported the patient's condition to the house surgeon, who informed me, so that I saw the patient within thirty minutes of the sudden onset of pain. The abdomen showed absolute rigidity (*rigidité de défense*). The patient having received Magendie, no longer complained of much pain. In spite of the low leucocytosis, 5,600, in spite of the low pulse, 92°, I made the probable diagnosis of intestinal perforation, solely on the strength of the sudden drop in temperature, the very distinct sudden sharp pain and the abdominal rigidity.

As there seemed to be very little shock, I decided upon immediate operation, against the general advice to wait if possible for twelve hours. Within twenty minutes operation was performed under anæsthætic narcosis. Incision in the right rectus about 5 inches long, between umbilicus and symphysis. On opening the peritoneum a large quantity of yellowish fluid of slightly fæcal odor was found in the general abdominal cavity. A number of small yellow fæcal flocculi were to be seen on the intestines, which were of bright red color. The glands in the mesentery were plainly enlarged. In handling the small intestine near the colon, the thickened Peyerian patches could be distinctly felt with the fingers. About 10 inches from the ileo-cæcal valve, two small perforations of the intestine were found, one complete and typical in its appearance, while in the other the ulcer seemed not to have perforated completely; nevertheless the probe found easy access into the lumen. Both perforations were closed with a number of fine silk Lembert sutures. While thus the operation was apparently finished (it took up to this point about twenty minutes), the very unusual bright yellow color of the abdominal fluid, which must have amounted to about a quart and a half, induced me to lengthen the incision in the rectus up to the costal margin. Immediately the gall-bladder presented itself, of a length of about 5 inches, with

a gangrenous fundus, showing two small perforations permitting the introduction of a medium-sized silver probe. The gall-bladder held rather closely two gall-stones of the size of hazelnuts. Cholecystectomy was performed in a few minutes, not presenting any technical difficulties (gall-bladder and cystic duct excised). The ligated stump was cauterized, a small gauze tampon put on the stump, another one in the lower angle of the wound over the intestinal sutures, the omentum placed as an apron over the sutured gut, and the entire abdominal wound closed. The operation lasted 45 minutes. The patient was brought to bed in very good condition, with pulse of good quality.

Blood examination, July 29:

Polynuclears.	72 per cent.	RBC, 4,800,000.
Lymphocytes.	20 per cent.	WBC, 7,400.
Mononuclears	8 per cent.	Hb, 80 per cent.
Eosinophiles	0 per cent.	Widal, 1-40, positive.
Basophiles.	0 per cent.	

July 29.—Cultures from gall-bladder: typhoid bacillus and coli.

July 30.—Blood cultures: bacillus typhosis in pure cultures.

The patient's temperature rose the day after operation. July 26, to 102.8° with a pulse of 124; on the 27th to 105°, with a pulse of 140; on the 28th to a temperature of 105.4°, with a pulse of 160; he continued to have temperatures for the next ten days between 104° and 105°; on the thirteenth day after operation remissions set in, the temperature varying between 103° and 100°, and the pulse between 120 and 112.

The man showed on the 28th and 29th symptoms of double broncho-pneumonia, with isolated areas of dulness over the left lung and dull tympany on right lung anteriorly from the fifth space to the eighth rib, below which flatness. Abdomen slightly distended, somewhat firmly held, not tender. Liver palpable 8 cm. below costal margin; edge sharp, smooth, not tender; jaundice clearing.

July 29.—Peritonitic facies continues; temperature 106.2°; general condition fair; tampons removed, not replaced; moderate drainage.

August 1.—General condition, good; took his nourishment

well; well retained; expels flatus freely; wound approximation good; moderate redness and induration about suture orifices; abdomen soft, not tender.

August 8.—General condition, fair; evening temperature still rises high; respiration rapid and shallow; nocturnal attacks of dry cough; icterus clear; took nourishment well; abdomen somewhat distended, soft, not tender; small granulating surface at the site of the two tampons, upper and lower angle of wound; remainder of wound healed solid per primary union; sutures removed.

August 10.—Right lung; dulness below sixth, flatness below eighth rib posteriorly; high-pitched bronchial breathing; many moist bubbling rales; sputa scant, brown, viscid, not fetid.

From Aug. 12 on, the condition became markedly worse; the patient died on the 16th of sudden cardiac collapse, with a temperature of 99.2° and a pulse of 136, twenty-one days after operation.

EXTRACT FROM AUTOPSY RECORD, Aug. 17, 1906.—Abdominal incision almost completely healed, extends from 1 inch beneath ensiform process to 2 inches above symphysis; no other scars; no pigmentation, no oedema, no jaundice. Abdomen distended.

Thoracic cavity: situs normal.

Pleural cavity: (a) Right, filled with 12 oz. of turbid yellowish purulent fluid, pleura very much thickened and adherent posteriorly. (b) Left, contains several drachms of clear serous fluid; no adhesions.

Lungs: (a) Right. (1) Upper lobe: apex shows several old calcareous foci, also several small tubercular cavities surrounded by connective tissue; besides this, a large focus of gangrene. (2) Middle and lower lobe congested. (b) Left. (1) Upper lobe: apex in similar condition as on right side. (2) Lower lobe congested.

Pericardium normal. Heart, slight myocarditis; heart muscle somewhat pale and flabby; no valvular lesions. Thoracic duct normal.

Abdominal cavity. Intestines: Small intestine presents a volvulus, comprising about 1 inch of intestine, the lower end 6 inches from ileocæcal valve; intestine above markedly distended with gas, below collapsed; the part involved, purplish; peritoneal covering glistening; no evidences of intestinal sutures can be found; the mucous membrane shows no evidences of ulceration except about 1 inch from large intestine two small round ulcers one-half the size of a split pea, punched out in appearance, margin not raised, base smooth.

Stomach normal; liver slightly enlarged and congested; gall-bladder absent, cicatricial connective tissue in its site; bile duct patent; spleen

congested, firm and enlarged, (8 x 4 x 4 inches), anterior margin shows two notches.

To sum up, we have here a case of unquestionable typhoid, proved by Widal being positive, by pure cultures from the blood, by anatomical condition of small gut observed during operation, and by culture of typhoid bacilli from extirpated gall-bladder (the latter proof not being absolutely conclusive, as typhoid bacilli have been found from three to four years after typhoid had been contracted).

The case is of the so-called ambulatory type, probably at the end of the fourth week, possibly later. Ten hours after admission, laparotomy is performed, as the diagnosis, intestinal perforation, is made. I must add here that owing to the rigidity of the abdomen at the time of my examination before operation, I could neither feel the enlarged liver nor the tumor of the gall-bladder with its stones. As it was night, the jaundice was not particularly observed. The operation revealed double perforations of ileum near the ileocæcal valve, which were closed by sutures, and perforation of gall bladder, which contained two large stones; the gall-bladder was extirpated. The patient stood both operations remarkably well, overcame his peritonitis and lived through his violent type of typhoid to die twenty-one days after operation, of gangrene of lungs and empyema, both probably of tubercular origin.

As to the diagnosis of perforation, a few words are to be said. If the case had been under observation longer, and not only ten hours, as was the case, the diagnosis of perforation of the gall-bladder might have been thought of. Whether anybody would then have thought of intestinal perforation besides, is questionable. I think, generally speaking, as well as under the existing conditions, one has every reason to be satisfied if perforation as such is recognized early enough. Cushing, Russell, Osler and others have called attention to the point that the status of leucocytosis is an exceedingly unreliable diagnostic point. In our case it proved to be only 5,600; besides this,

the pulse, instead of being, as typical, very high, contrasting with the low collapse-temperature, was also low, viz., 92. But this meant to me simply that the man had not developed a peritonitis as yet. Altogether I based my diagnosis of abdominal perforation mostly on the sudden, very marked pain, combined with a fast drop of temperature and rigidity of the abdominal muscles. As Osler says, one must operate when one has a probable diagnosis. To wait till all the symptoms of perforation are established, means to kill the patient. "Ce sont les medications qui tuent, par le temps qu'elles font perdre."—Lejars.

As to the sequence in which the perforations occurred, whether the gall-bladder or the intestine showed perforation first, with its influence on the abdominal cavity,—I dare not offer an opinion; nor about the point, which perforations produced the violent symptoms leading to an operation. We must be satisfied with the proven fact that in a case of typhoid the gall-bladder and the small intestine were perforated practically simultaneously.

One point of the post mortem needs explanation, and that is the volvulus which was found at the time of the autopsy. The report of the pathologist as well as the verbal report of Dr. H. Fischer, my adjunct surgeon (I myself was not present), indicate that the volvulus was not complete, so as to be fatal; it was somewhat permeable. Whether its formation had anything to do with the intestinal sutures—of which no signs could be found—is an open question, but deserves our attention. Theoretically, the possibility cannot be denied, that the suturing of two holes in the gut only a few centimetres distant from each other, might produce a kink, which could eventually lead to an incomplete volvulus.

As far as accessible to me, I have looked up the entire recent literature on operations in typhoid complications, and have been unable to find a case like the one I have reported. There is one case reported in the *Philadelphia*

Medical Journal, 1901, by Hermann B. Allyn, where a typhoid case (admitted probably in the second week) was operated ten days after admission for intestinal perforation. The perforation in the gut was not found, nor a perforation in the gall-bladder, although its region had been examined digitally. The patient died three days after operation of peritonitis. The autopsy revealed an opening 1 cm. in diameter in the gall-bladder, communicating with a small opening in the hepatic flexure of the colon, 5 mm. in diameter. I mention this case only for the sake of completeness, as it has very little in common with my own. The simultaneous perforation of gall-bladder and colon was apparently produced by a contact infection, the perforations were both not found during operation, and the patient died of peritonitis.

Erdmann, in his paper on primary typhoid perforation of the gall-bladder, read before this Society in February, 1903, had collected up to that time seven cases of perforation of the gall-bladder which had been operated upon, of which four cases recovered.

While the literature of intestinal perforations in typhoid has increased considerably in the last years, reports on perforations of the gall-bladder have been very scarce,—we find one by Park Weed Willis, Seattle, Washington, in *Northwest Medicine*, 1904, where perforation of the gall-bladder was found, and the perforated gall-bladder, containing no stones, was stitched into the abdominal wall. The patient died two weeks after operation of peritonitis, which the author ascribes to obstructions from adhesions, for which he operated shortly before death. His description of the case does not prove to me that the peritonitis was due to adhesions, but rather to his failure to extirpate the gall-bladder at the first operation.

Zesas, in his extensive paper published in the *Wiener Klinik*, 1904, "Ueber die Resultate der chirurgischen Therapie der typhösen Perforationsperitonitis," gives statistics of 250 cases operated for perforative peritonitis,

with 95 recoveries, but no perforation of the gall-bladder is to be found among them.

As stated above, a rather careful perusal of the American, English, German and French literature since 1903 has failed to show any further publications reporting operations for perforation of the gall-bladder in typhoid, while an operation for apparently simultaneous perforation of the gall-bladder and ileum in typhoid seems to be unique.

INTESTINAL INTUSSUSCEPTION.*

BY ROBERT C. COFFEY, M.D.,

OF PORTLAND, OREGON.

Surgeon and Medical Director of the North Pacific Sanatorium.

INTESTINAL intussusception is one of the last of the serious intestinal lesions to yield good results by surgical means, and yet the very nature of the trouble makes it purely a surgical disease. The general mortality of this malady has been variously estimated at from seventy per cent. to ninety per cent. and modern surgery has not so far lessened it to any great degree. This, I believe, is due to the fact that we are relying largely upon the mortality tables of the older operators which were compiled before the inauguration of modern methods in intestinal surgery. A few years ago some authorities estimated mortality of gastro-enterostomy at thirty per cent., or considered an intestinal excision as an exceedingly serious matter. To-day the mortality of these operations in the hands of surgeons doing a great deal of that work is not materially greater than the operation for appendicitis. The great diminution in the death rate in this latter class of cases is due, first, to the fact that formerly the conditions were not diagnosed until the patient was moribund. Secondly, the technical methods of operating were deficient. Now the diagnosis is made earlier, while the patient yet has vitality, and the operation is done more skilfully—hence the lessened mortality. The conditions mentioned above, which existed in stomach surgery ten years ago, still exist in relation to acute intestinal obstruction. Progress in the treatment of this class of cases has been delayed longer than in stomach cases because of the acuteness of the condition, thus depriving the practitioner of time for deliberate study of his case and preventing his making a diagnosis until the vital-

* Read before the Idaho State Medical Society, October 5, 1906.

ity of the patient is exhausted, while diseases of the stomach and gall-bladder are usually chronic and allow time for deliberation and investigation. Intestinal intussusception, or invagination, which comprises more than thirty per cent. of all acute intestinal obstructions, is more fatal than other forms of obstruction because of greater difficulty in making an early diagnosis. In most other forms of intestinal obstruction, the occlusion of the lumen of the bowel is almost or quite complete, which is not the case in intussusception. The one misleading feature in intussusception is that in a great many cases the obstruction is not complete and the bowels act, gas passes and there is little or no distension. Another reason for the great mortality is that it most frequently occurs in children, and the practitioner is at a loss to differentiate between this condition and an ordinary gastro-intestinal disturbance or colic; for before he is called some one has given a large dose of castor oil which may have been effectual. Thus the doctor is misled until the patient is almost dead; an infant is a poor subject in acute abdominal diseases for surgery.

Without going into detail I think we can say in a general way that the three most frequent causes are, (1) A congenital laxness of the structures in the neighborhood of the ileocæcal valve.* (2) A partial or complete intestinal obstruction by a growth or some form of constriction. (3) The presence of a pedunculated tumor within the lumen of the intestine. All these causes are made effectual or active by the normal peristaltic action of the intestine, which tends to grip any foreign or unusual body and force it on down the intestinal tract. It has been my fortune to have seen quite recently, cases of intussusception produced by each of these causes. I may mention two cases of the first type.

One was a three-year-old child in which there was not more than an inch of invagination. There was very little ob-

*This the writer has studied with interest in intestinal experiments in which the motor nerves of the intestine had been cut, thereby producing paralysis and intussusception.

struction and almost no trouble in reducing it. The symptoms were nausea, vomiting and pain in the neighborhood of the umbilicus, which symptoms had existed for several days. Marked marasmus existed. Cathartics, however, produced results. The diagnosis was not made positive until the abdomen had been opened. The intussusception was easily reduced and the intestine was sutured to the mesentery, thus partially rolling the intestine up in its mesentery, as shown in Fig. 1., to prevent recurrence of intussusception. Patient recovered.

Another case was one in which the patient was nine years old and in which the cæcum, appendix and ileocæcal valve had formed an intussusception. This was very acute and had only existed a few hours. The condition was so acute as to require the services of a physician from the very beginning. The patient suffered with great pain and distress, resembling an acute appendicitis, but as there was a decidedly palpable tumor so soon after the onset of the attack, we were able to rule out appendicitis. It was easily reduced and the cæcum was sutured to the peritoneum in its neighborhood, as recommended by the authorities, and the ileum was rolled up in its mesentery as shown in Fig. 1. Patient recovered.

The third case was that of a Chinaman about fifty years of age. This was due to the second cause mentioned above. I was called in consultation with Drs. Locke and Gullette. The patient had had no action of the bowels for thirteen days and was in an extreme condition. Within twenty-four hours preceding operation a tumor was discovered protruding through the anus which examination proved to be the apex of an intussusception. We did an abdominal section, and, by pushing up from below through the rectum, we were able to reduce the intussusception but found practically a complete obstruction which proved to be a carcinoma involving almost the entire circumference of the gut at the sigmoid flexure. So we did an incision and an anastomosis which was very effectual, as was shown by his passing a large quantity of dark malodorous fæcal matter by the anus at once. He lived for more than two days and then died of stercoremia and peritonitis. While this was a very desperate case, I feel that if I were doing another case, I would not perform the operation in exactly the same way, but would prefer to do it in two stages. The point I wish to illustrate by this case

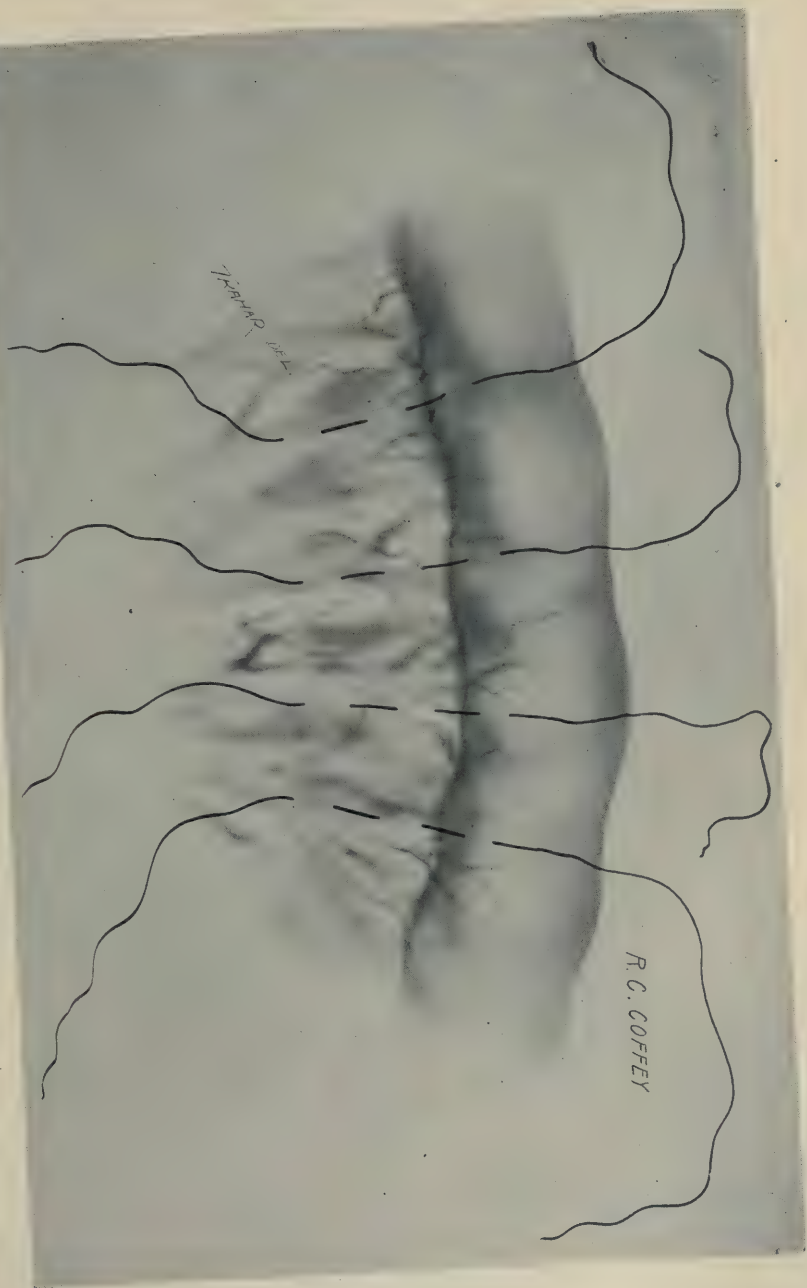
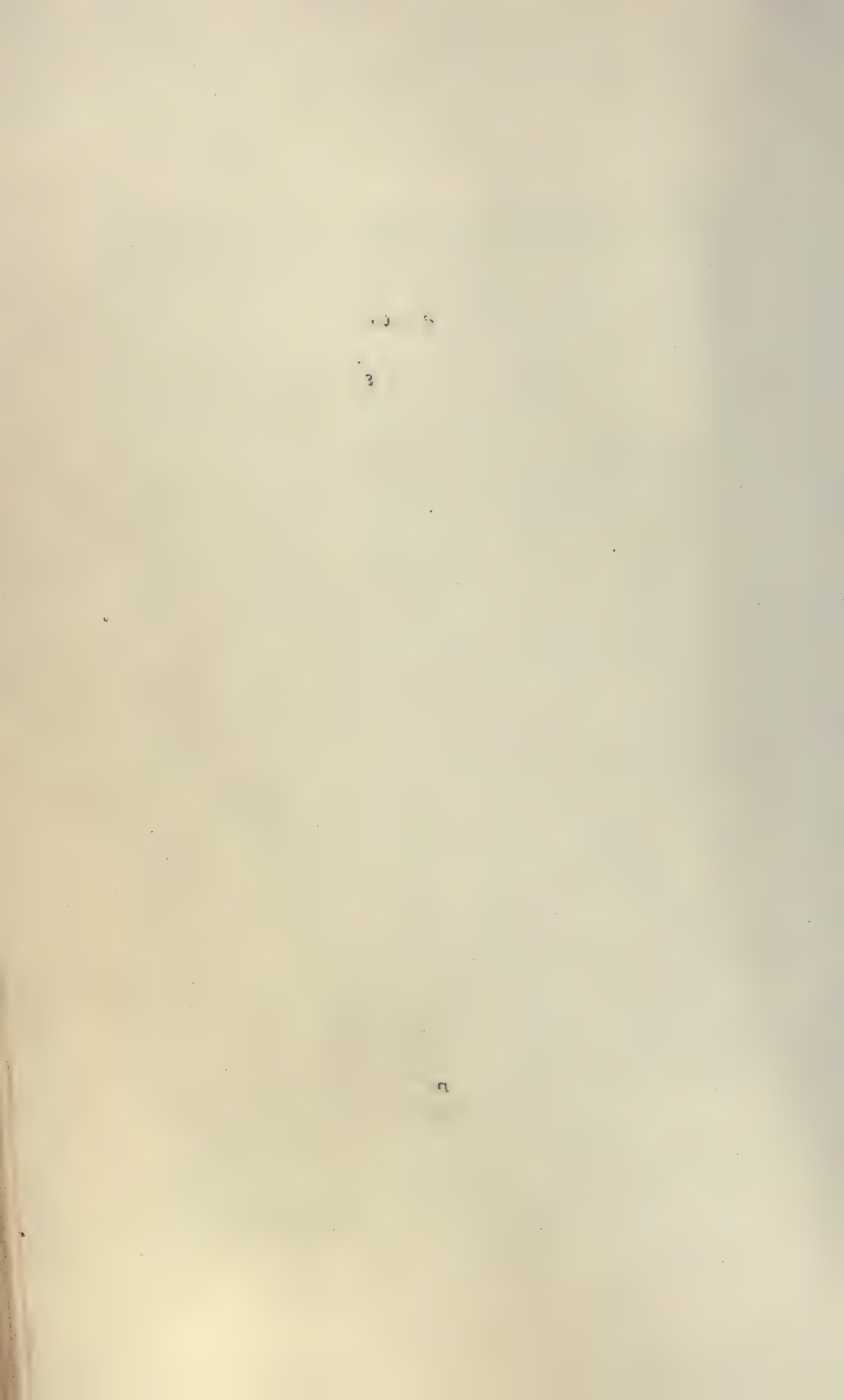


FIG. 1.—Rolling intestine in its mesentery to prevent recurrence of intussusception.



is that a movable tumor, even though it is in the form of a stricture, is a prolific cause of intussusception, especially if in the region of the sigmoid flexure.

The last case which I wish to relate, and which was the subject from which the accompanying pictures were made, is a classic one in many ways. I have therefore attempted to illustrate it. Fig. 2 illustrates the pathological conditions existing. The case has several ideal features as far as description is concerned. First, it is a simple and yet extensive intussusception and involves that part of the intestine most frequently affected. Second, it has the most ideal cause, viz., a pedunculated growth within the intestine on which the peristaltic wave may act. Third, this particular growth happens to be a structure which has often hitherto been overlooked (a Meckel's diverticulum), which in this instance was inverted. (Authorities generally agree that a Meckel's diverticulum is present in some form in two per cent. of all human beings; therefore it is probably the cause of more cases of intussusception than we have recognized.) Fourth, it is ideal in its pathologic termination, viz., gangrene was produced. Fifth, it was ideal in that the lumen was still patulous despite its great length. Sixth, we used what in my opinion is the ideal treatment for a gangrenous intussusception (radical removal), notwithstanding the reports of most of the operators indicate its inadvisability. The history of the case is briefly as follows, as related by the patient's mother.

Patient aged 7 years. When he was two years old he had severe cramps, with cold perspiration standing out on his face and body, lasting about thirty-six hours. During the attack, enormous doses of cathartic medicines were administered, most of which were vomited. Finally an action was produced which contained quantities of blackberry seeds, and to their presence was attributed the attack by the physician and the people. During this attack he vomited every few minutes. From this time he had an attack about every month, varying in severity, but one striking feature was that he always passed blood at every

attack. Sometimes his attacks would occur every week. This state of affairs kept up for four years, when he had a very severe attack, with jaundice, and passed a lot of blood. This attack, which was about one year ago, began at 7 A. M. (and we may here state that all the attacks began at this time of day). In the afternoon at 6 P. M. he was better, and was better the next day. He never had fever during any of these attacks. From this one, just described, to the beginning of the present, he had light spells, no blood passing. Three weeks prior to this final attack, he had one which was quite severe, but which lasted only a few hours. This time he did not vomit but was nauseated.

On Sunday, June 8, 1906, he had a very severe attack, screamed with pain, had great pallor, and cold perspiration. Vomited every few minutes during the day. Was better, apparently, at 4 P. M. when cramps ceased, but vomiting continued until 7 P. M. Then he was hungry and was given bread and milk, but the soreness in his bowels did not cease as usual, and on Monday he remained in bed with but little appetite. On Tuesday he was still sore but was up a portion of the day, his bowels acting without a cathartic. Wednesday he played vigorously and was apparently as well as usual. Friday morning at 7 A. M. he was seized with a very severe attack, similar to the others, when his mother began to give castoria in large doses but found it was not effectual as it had been in previous attacks. Dr. Alice Hall Chapman, of Woodland, Washington, was called at this time and arrived at 12.30 P. M., remaining for two hours, injecting salts, castor oil, etc., and finally suspending him by his feet for an hour to cause the enemata to go high in the bowel. Finding this inefficient she advised them to bring him to the hospital, which, owing to the out-of-the-way place and poor facilities for travel, required a good deal of time to reach Portland. On the way to the hospital his bowels acted and he passed some gas and very dark fluid and faecal matter, but nothing that could be identified as blood. After this he had no pain. He arrived at the hospital at noon, Saturday, June 14.

On admission he presented sunken features and the characteristic expression of a serious abdominal trouble. There was no distension. A large mass was palpable on the right side extending up under the ribs. He was taken immediately to the operating room and the abdomen opened. The intussusception



FIG. 2.—Sectional view of extensive gangrenous intussusception, due to an inverted Meckel's diverticulum.

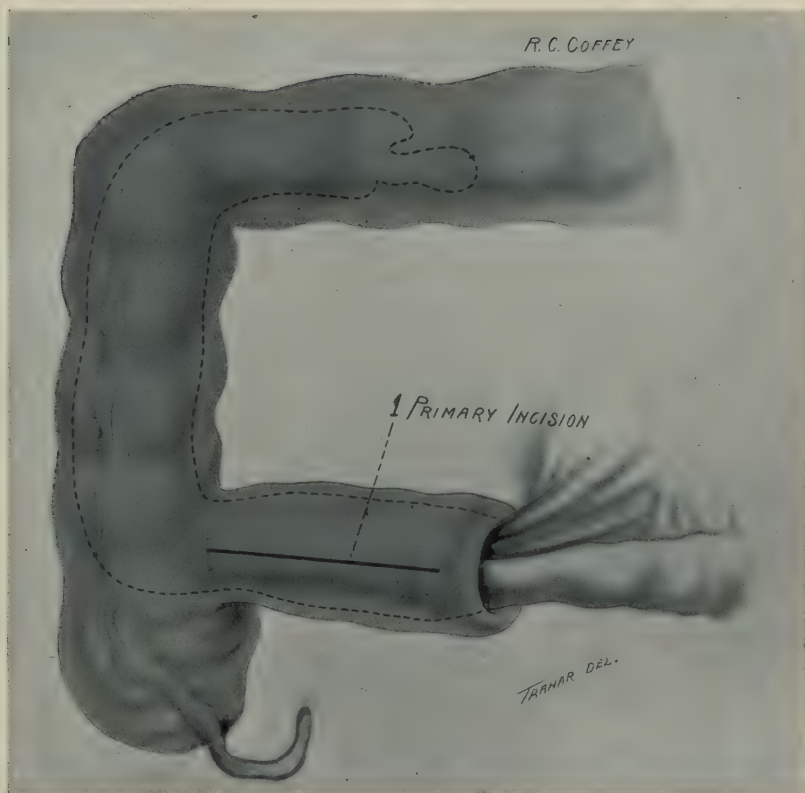


FIG. 3.—Diagram showing incision through which intussusceptum was removed (indicated likewise in succeeding pictures).

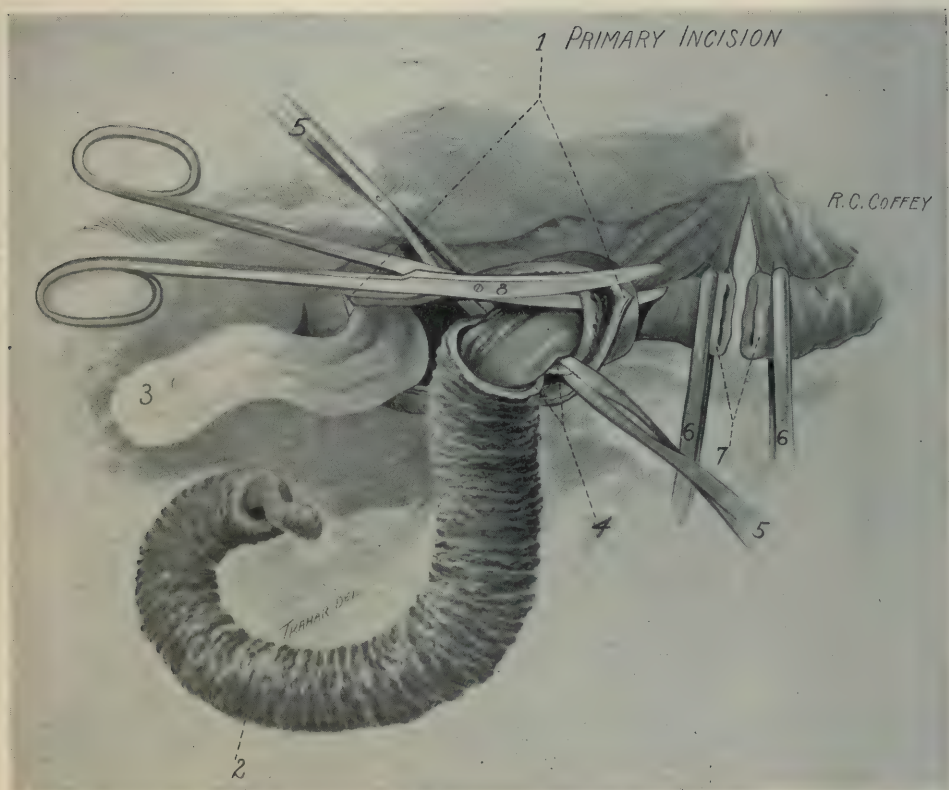


FIG. 4.—Steps in operation. 1. Make primary incision indicated in Fig. 3. 2. Withdraw intussusceptum and wrap in gauze. 3. Pack distal end of intestine with gauze. 4. Cut middle layer of intussusceptum by circular incision. 5. Catch bleeding arteries with forceps. 6. Clamp healthy intestine with two forceps. 7. Cut between forceps. 8. Complete primary incision, laying open distal end of the ileum and freeing intestine to be removed.

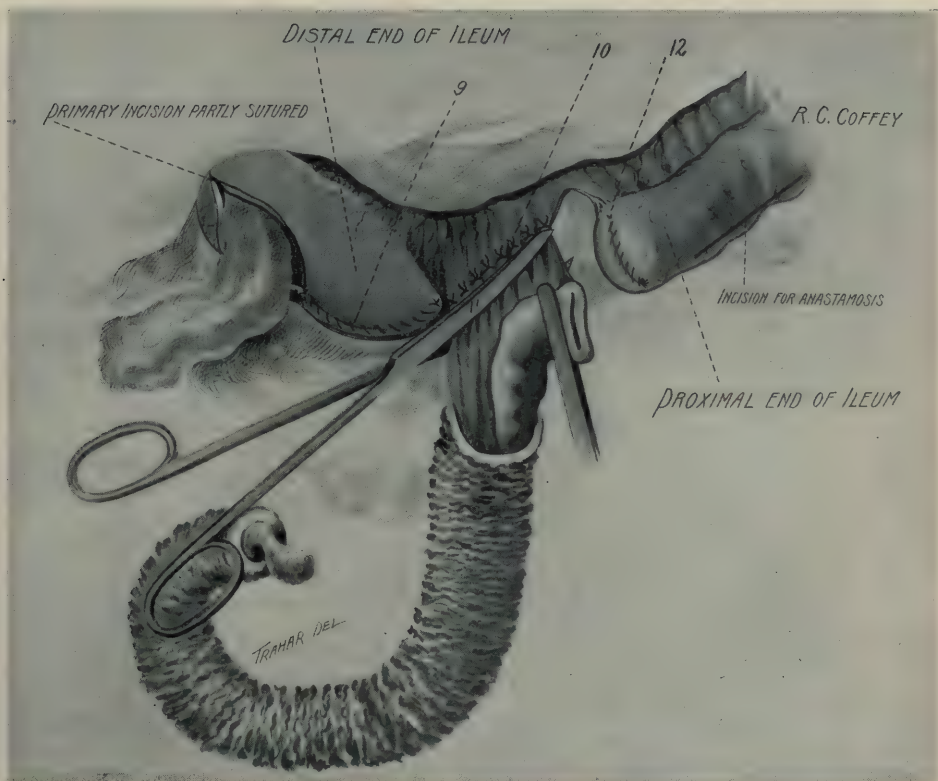


FIG. 5.—Steps in operation. 9. Partly suture distal end of the ileum. 10. Ligate mesentery in sections. 11. Cut mesentery and remove gangrenous intestine. 12. Suture proximal end of the ileum.

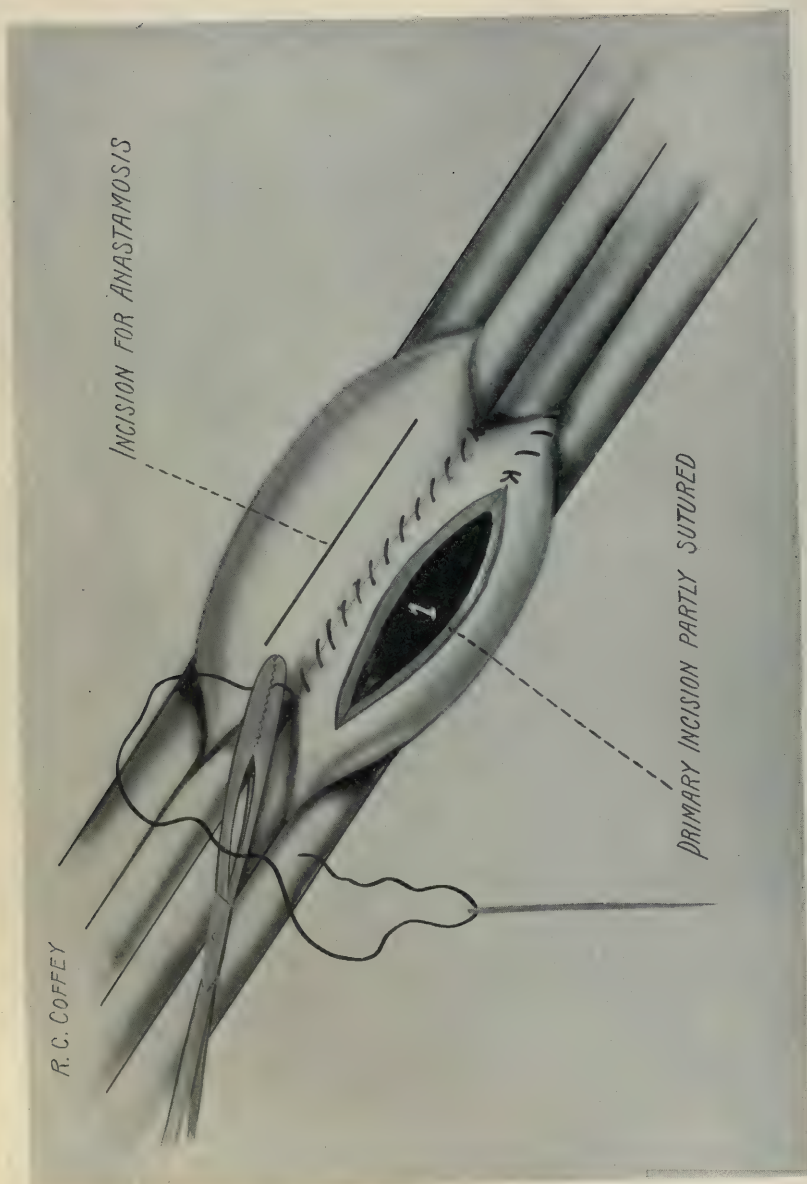


FIG. 6.—Make lateral anastomosis between the proximal end of the ileum and the distal end of the ileum at the primary incision by the method usually used in doing gastro-enterostomy.

shown in the picture was found and identified. The abdomen was packed full of gauze to prevent exposure of the other intestines. We then tried for several minutes to reduce the intussusception but found it impossible; so after packing many layers of gauze and delivering the affected part of the intestine to the surface, we made the primary incision (1) as shown in Figs. 3 and 4, and mopped out all the fluid in sight. We found the enclosed intestine gangrenous and that there existed a constriction at the ileocæcal valve, necessitating a partial cutting of the valve. (2) The intussusception was then withdrawn and wrapped in gauze. (3) The fluid inside the intestine was mopped out with sponges and a long piece of gauze was packed into the cæcum to prevent regurgitation of intestinal contents. (4) The second layer of intestine was cut in two in its circumference. (5) The edges of the intestine were clamped at the bleeding point to control hæmorrhage. (6) The ileum was then clamped and (7) cut. (8) The cæcal stump of the ileum was slit wide open with scissors by extending the primary incision. (9) This was sutured partially, leaving an opening large enough for an anastomosis (Fig. 5.) After this the gangrenous portion of intestine was left hanging by its mesentery only. (10) This was ligated in sections and (11) cut with scissors. (12) The proximal end of the ileum was sutured and the clamps removed. The distal and proximal ends as indicated were brought together and an anastomosis was made with clamps, as shown in Fig. 6. The patient was not seriously shocked by the operation, but very small hopes were entertained of his living. The next day his temperature went to the neighborhood of 106°, which symptom is pointed out by Barker as being peculiar to these cases. This patient made a complete recovery and has remained so for four months.

For some reason radical operation has not been as successful as we would naturally suppose, and most of the cases of gangrenous intussusception are fatal. Barker has devised a means of cutting off the intestine within the intussusciptions, suturing the peritoneal layers together as they lie in contact, and then suturing the edges of the peritoneum at the beginning of the intussusception. I believe it is not considered to be very effectual in gangrenous cases. This operation has found considerable favor in

the hands of most surgeons and is considered a good compromise between no operation and radical operation, but has the disadvantage that, even if the patient recovers, a stricture is likely to occur which finally requires a secondary operation or produces death. Treves states that cases where suturing has been carried out, whether gangrenous or not, have had a mortality of about 86 per cent. Concerning the gangrenous cases, Moynihan quotes Barker as saying "He had never seen recovery after resection in gangrenous cases and never expected to see it. The only hope lay in early operation."

We are prepared to agree with Mr. Barker that the only hope for greatly reducing the mortality in these cases is in early diagnosis and early operation, which, like appendicitis, if done in the first twenty-four hours is usually found reducible and with not a very large mortality, except in young infants. The harm is done by the use of cathartics and the temporizing with all kinds of remedies, hoping to finally avoid operation, when in reality the surgeon should be called as soon as the trouble is suspected. If the surgeon occasionally opens an abdomen in which there is no obstruction he will do very little harm. The results in this case here related have strengthened the belief that I have held for some time that there should be no great difference in the excision of a gangrenous intussusception and a gangrenous intestine under other circumstances. The method here described was adopted for the occasion and is applicable in cases of extensive gangrenous intussusceptions in which too much intestine is involved in the intussusceptions to justify excision of the entire mass, including the intussusceptions. I am of the opinion that radical excision for gangrenous intussusception will in the future be done more frequently and successfully than it has in the past, though, of course, a conservative compromise will be necessary in many cases. I believe the method described in this case is cleaner than any other method I have seen described for extensive gangrene, and I would certainly do the operation in a similar manner in another similar case.

RESECTION OF TEN FEET, TWO INCHES OF SMALL INTESTINE, WITH RECOVERY.

BY EDWARD STAEHLIN, M.D.,

OF NEWARK, N. J.

J. T., a man, aged forty-seven, married, native-born, fireman by occupation, a strong, healthy man actively engaged in his work, who never had been sick. The only bodily infirmity he has had was a large indirect reducible hernia on the right side. This he had had for thirty years, during which time it had always been reducible.

On the morning of February 25, 1906, while turning over in bed, he experienced a sharp pain in the region of his hernia, and for the first time since he had it was unable to reduce it. The pain grew rapidly worse (this was 7 A.M.) and vomiting set in at once. Assistance was summoned, but the hernia could not be reduced. The pain became excruciating and vomiting was continuous. He was sent to the City Hospital at 11 A.M. and operated upon at once.

The protrusion was as large as a good-sized head and very tense, and tympanitic on percussion. The pulse was fair, temperature subnormal, the facial expression very anxious and decidedly pinched. He vomited and retched continuously. On exposing the gut the coils brought immediately to view were gangrenous, and the underlying coils were highly congested and gangrenous in places here and there throughout their entire extent. The entire mesentery involved had turned a deep mahogany color; the veins were thrombosed, and the arteries had ceased to beat. The condition of affairs was evidently as follows: There was a tremendous hernia of the small intestine which had come down. This had always been readily replaced through the greatly enlarged ring, but on this particular morning, while in the act of turning over in bed, an additional knuckle of gut was forced into the ring in consequence of the increased intra-abdominal pressure prompted by the muscular exertion in the act of turning over, and so the ring was effectively occluded and caused strangulation.

The entire length of gut which contained gangrenous areas

was securely clamped off and removed. Then the mesentery was ligated and resected close up to its upper attachment. This latter was ligated by a series of interrupted chain ligatures of catgut. The ends of the gut were then approximated and reunited by end-to-end anastomosis; celluloid was used as suture material. Two layers of sutures were done, the first through-and-through and the second layer through muscular and serous coats (Lembert). The remnant of mesentery was then approximated and the gut was dropped into the abdominal cavity. Gauze drainage was used.

The patient rallied well and the dressing was changed for the first time one week after the operation. Three days later when the dressing was changed gas escaped through the wound; on the following day there was a fecal discharge. From this day on the wound was dressed daily and in nine days the fecal fistula had closed.

He was discharged cured in seven weeks. His convalescence was watched with a great deal of apprehension lest the stools should become permanently liquid and so cause gradual inanition. This was not the case, however, and within two months after his discharge from the hospital he resumed his duties as a fireman. He still wears a truss, as the attempt for radical cure was abandoned on account of the conditions encountered.

He eats and drinks as before and has regained his former weight.

The entire length of gut removed was ten feet two inches, and it was taken as nearly as could be made out from the middle of the small intestine.

FRACTURES OF THE OS CALCIS AND ASTRAGALUS.

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AND

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OF BOSTON, MASS.

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WE have been led to undertake this study, because during the last few years many cases have come to our notice in which a failure to accurately diagnose the condition has led to results certainly less good than might have been obtained by better directed methods. At the outset of the investigation we supposed these fractures to be uncommon, but this opinion we have been obliged to change and now incline to the view that they are more common than has been generally supposed.

Our deductions are based upon the study of 111 cases admitted to the Massachusetts Hospital during the last fifteen years. In many cases the notes are not sufficiently accurate to permit conclusions to be drawn upon many of the minor points, and we have confined ourselves in most instances to the discussion only of those cases in which we have personally studied the X-ray plates or been able to examine the patient a considerable time after the injury.

Etiology.—Age, occupation, and sex: As might be expected the occurrence of these fractures follows the rule common to all severe fractures, that they occur more frequently in those whose age and occupation expose them to external violence. Thus no fractures in this series occurred in children, very few in women, the vast majority in men in the prime of life.

Frequency: No method of estimating the frequency with

which any fracture occurs is wholly satisfactory, as the situation of the observer, the class of population with which he has to deal, and entirely accidental causes, influence the number very greatly. It may, however, be of interest to note that during the last eleven years there have been in the hospital 83 cases of fractures of astragalus and os calcis, 204 cases of Potts' fracture and 396 cases of fracture of the femur.

Method of Production: To decide by exactly what mechanism these fractures are produced, is a matter of more than ordinary difficulty, for the various factors entering into the question are many and it is practically impossible accurately to estimate the value which should be given to each. The problem differs materially from that in fractures of long bones or bones not situated in such immediate proximity to many complicated joints. It would obviously be important, were it possible, to know the exact position of the foot at the moment the force was applied. Thus, theoretically at least, the amount of extension, the presence of inversion or eversion, the condition in regard to tonicity of the various muscles acting upon the foot, and the strength of certain ligaments, must be known if we are to arrive at a correct estimate of these various factors. While much ingenuity has been expended in the attempt to give to these factors their correct importance, it does not seem to us, with the data at hand, possible to apportion their value with sufficient accuracy to yield valuable results. It is, however, entirely possible, and quite important, to note in general how these accidents occur.

Fractures of the Os Calcis: These fractures are in the great majority of cases true compression fractures, and are generally due to a fall from a height on to a hard substance, as the ground or the floor of a building. The bone is crushed between the astragalus above and the ground or floor beneath, the astragalus being protected from the direct force of the blow by its situation between the two malleoli, and probably also by the crescentic contour of its upper surface, which tends to distribute the force of the blow. Some of the observations upon this point by our Continental brethren are not without their

humorous aspect. One gentleman, for instance, gravely assures us that if a man falls from a height of fifteen or eighteen feet onto a stone floor, the os calcis will be broken, provided, always, that the floor does not give way. The bone may also be broken by direct violence, as in the case of one patient, whose heel was caught between the curb-stone and the wheel of a wagon; or by weights falling upon the foot so as to strike upon the side. These are not, however, common methods of production. In our series there are sixty-three cases in which the nature of the accident is described. Of these, fifty-nine were due to falls from a height, and four only were produced by direct violence.

Astragalus: As we have already suggested, the protected position of this bone makes it less likely to be broken by crushing strains, but it is nevertheless frequently fractured in this way. Thus Hamilton,¹ in ten cases, found that nine were due to falls from a height, and Gaupp,² in sixty-one cases, found that forty-five were produced in this way. In our series the method of production was known in thirty-five cases. Of these, twenty-one were due to falls from a height and fourteen to direct violence, (see Fig. 20). This appears to be a considerably larger proportion than that noted by most previous observers, but the series presented by Hamilton is too small to warrant accurate deductions, and our series is sufficiently limited, so that the proportion of three to two is likely to err considerably in either direction. It is important to note, however, that the proportion of the fractures of this bone due to direct violence is much greater than that of the os calcis.

Pathology.—Our knowledge of the pathology of these fractures must be derived largely from the study of X-ray plates, as the number of cases in which the accident is fatal—and it is possible to study the exact conditions at autopsy—is very limited and the position of the bones is such that little reliance can be placed upon inferences drawn from examination with the fingers. It is perhaps not too much to say that most of the errors occurring in diagnosis result from too much

dependence being placed upon methods of examination other than the X-ray. It would be an endless task to attempt to describe all the possible fractures of these bones, and we have not ourselves felt competent to decide, even from a careful study of an excellent series of X-ray pictures, the exact details of the fracture in many cases. Certain general types of fractures, however, can be distinguished, and we have made our classification rather with a view to the possibilities of treatment than following the lines of previous observers.

Os Calcis: We have been able to distinguish three general types of fracture of this bone—(1) That in which the fracture has been confined largely to that portion of the os calcis lying behind a vertical plane through the middle of the body of the astragalus. These we have described as heel fragments. They may be further subdivided into (*a*) cases with one large heel fragment (see Figs. 2, 3 and 4), (*b*) cases of small heel fragments which practically correspond to the avulsion fractures of other authors (see Fig. 6), and (*c*) cases showing cracks or fissures in the portion of the bone above noted, which, had the injury been more severe, would have resulted in the breakage of heel fragments (see Figs. 7 and 8). (2) That in which the force of the blow has been expended upon that portion of the os calcis lying beneath the astragalus, in front of above plane—in other words, roughly, the anterior half of the bone. These we have described as comminution of the anterior half, as in our series all the cases show comminution (see Figs. 10 and 11). (3) In this class we have placed those cases in which the whole os calcis is crushed and converted into what might be described as a bag of bones, the fragments being held together, apparently, only by the shreds of periosteum and by the surrounding soft parts. The bone is literally shattered. These cases we have described as completely comminuted (see Figs. 12 and 13).

In only nineteen cases have the X-ray plates been sufficiently perfect so that accurate deductions could be drawn. Of these, Class 1 (heel fragments) contains eight cases; Class 2 (the cases of the anterior comminution) contains five cases;

Class 3 (the completely comminuted cases) contains six. From this it appears that Class 1 is slightly more common than either of the other classes, but the difference is not sufficiently great to justify conclusions.

As fracture of the sustentaculum tali has been frequently mentioned by other observers, it would be improper to pass it without mention. It belongs, however, to the anatomical rather than to the clinical method of classification, and while it is by no means improbable that such fractures might take place even without other damage to the bone, we have seen no cases in which this has occurred as a distinct type. In many of the cases—notably, those in Class 3—there is undoubtedly fracture of this process, but as it is only an incident of the whole injury and not in itself important, we have not been inclined to give it prominence. Our study of the X-ray plates makes us doubtful whether we could distinguish such a fracture if it occurred, and to identify it by any other name is to depend upon mere guess work.

Astragalus: The classification of fractures of the astragalus is much more simple than those of the os calcis. The position of the bone is such that it has a protected part and an exposed part; the body being largely protected by its position between the malleoli, and the neck, exposed particularly to violence giving a twisting strain, or to crushing blows falling in front of the body.

1. Fractures of the Neck.—This is much the most common fracture of the astragalus (see Figs. 18, 19 and 20). Gaupp, in forty-nine cases, saw it eighteen times, and in our series it occurred in ten out of fifteen cases in which the plates were satisfactory. Of these cases, five were due to falls; five due to direct violence.

2. Fractures of the Body.—This fracture is due to a crushing force similar to that which results in fracture of the os calcis, sometimes occurring with the latter, and it is difficult to decide what factors influence its production. The variety of fractures is very considerable, varying from two large fragments to complete comminution of this portion of the bone.

It has not, however, seemed to us that a more minute classification was important from the point of view of treatment. In our series of fifteen cases it occurred five times, always from falls (see Figs. 21 and 22).

Os Trigonum³: No discussion of fractures of the astragalus is to-day complete without some reference to this curious little bone, which is sometimes attached to the astragalus as a process, on its posterior aspect, sometimes entirely detached, and joined only by a cartilaginous union, sometimes partially fused, showing that it had previously been detached. Its importance lies largely in the fact that when displaced upwards as a result of injury to the foot, it is frequently described, from an examination of the X-ray plates, as a fracture, and it is always wise to bear the fact of its occurrence in mind and not be misled by the appearance of an apparently isolated fragment just behind the posterior border of the astragalus (see Fig. 17).

Diagnosis.—An extended discussion of the methods of diagnosis in fractures of these bones would be out of place here, as they differ in no essentials from those applied to fractures elsewhere. We wish, however, particularly to draw attention to the fact that these methods have been so inaccurate as to prove conclusively that they are not to be depended upon. Thus, Ehret⁴ in a series of forty-seven cases, found that only three had been correctly diagnosed immediately after the injury. In our series of sixty-six cases of fracture of the os calcis, a large majority of which came directly to the hospital and were under the care of a skilled staff with most modern methods at their command, seven cases were wrongly diagnosed and as a result wrongly treated. Of these seven cases, two were hospital cases and five had been under the care of other practitioners; three were regarded as sprained ankles, one as a Potts' fracture, one as a dislocation, two apparently as simple bruises of the foot. As will later appear, the results of the treatment of these fractures are so bad that no method which will lead to their more accurate treatment should be

neglected. The tenderness and swelling are such that even in the most skilled hands accurate diagnosis is entirely impossible except by means of the X-ray, and we believe that no case can be considered as having been properly diagnosed until a satisfactory X-ray plate has been examined.

In the case of the astragalus, in thirty-eight cases three were wrongly diagnosed—all of these by practitioners not connected with the staff. One was regarded as a contusion, one as a sprained ankle, one fell into the clutches of a "natural bone-setter," who failed to set the bone. All these cases were fractures of the neck, which theoretically should be easier to detect than fractures of the body of the astragalus or of the os calcis. The statement made above in regard to the use of the X-ray in fractures of the os calcis is equally true and its effect upon treatment is even more marked, as accurate diagnosis will enable the surgeon to decide exactly what condition he has to deal with and what measures must therefore be taken. This will be further discussed under "Treatment."

Prognosis.—We cannot better illustrate the probable outlook in these cases than by discussing the results which have actually been obtained in the cases under our observation. We have been much impressed by the fact that the majority of the results are not good as compared with most other fractures, and we have thought that in some cases, at least, somewhat better results might have been obtained by different methods of treatment.

The cases which we have used in this classification are only such as we have personally examined more than one year after the injury. Many of them were seen more than three years after injury, so that we believe we have obtained a fairly satisfactory view of the ultimate results. We have classified the results as "Good," "Fair," and "Bad," which terms we have defined as follows:

1. Good.—Those cases having a useful foot without pain, or at least without much pain. None of them are entirely

normal, and in the great majority there is marked limitation of lateral motion (see Figs. 4, 5 and 9). In our series at least, no case was seen with anything approaching a return to normal condition of the bones.

2. Fair.—Those cases in which the patient has been able to return to work and in which his earning capacity has been but slightly impaired, but in which pain, some disability, and the necessity for wearing pads, plates, or other form of apparatus, have been present (see Fig. 3).

3. Bad.—Those cases in which there is marked disability and the earning capacity has been distinctly diminished (see Fig. 16).

Os Calcis: We have been able to examine twenty-six cases in which the end result of the injury was known and the patient personally seen more than one year after injury.

These showed: Good result, 13, or 50 per cent.; fair result, 10, or 38 per cent.; bad result, 3, or 12 per cent.

Examining these cases more closely, with a view to determining what type of fracture gave the best result, the X-ray plates have been sufficiently satisfactory in twelve cases. Of these, seven were classified as "heel fragment" cases, and of these 5 were good, 1 fair, 1 bad.

Five cases were classified as "comminuted." Of these, none were good, 4 fair, 1 bad.

It seems, therefore, just to conclude that the cases classified as "heel fragment" cases show a better end result than the cases with much comminution.

Astragalus: We have been able to see and examine eight cases of fracture of the astragalus. These showed: Good result, 2, or 25 per cent.; bad result, 6, or 75 per cent.

From such a small series it did not seem possible to determine what type of fracture was the most favorable. It did, however, appear that cases with a fracture of the neck did not

always give bad results, and that the amount of displacement between the body and the neck was, as would be expected, the most important element in permanent disability. It is very obvious from the results that this fracture gives a result distinctly worse than fracture of the os calcis.

Duration of Disability.—Since, at the present time, many of these cases become the subjects of litigation, it is important to inquire in regard to the duration of disability.

Os Calcis: The duration of disability was known in twenty cases of fracture of the os calcis. Of these, 14 were disabled not in excess of six months; 1, from six months to a year; 3, from a year to a year and a-half; 2, from a year and a-half to two years. The average duration of disability was somewhat in excess of six months.

Astragalus: The duration of disability was known in nine cases of fracture of the astragalus. Of these, in 1 it was not in excess of six months; in 2 it lasted from six months to a year; in 2, from a year to a year and a-half; in 1, from a year and a-half to two years; in 3, over two years.

The average disability was about a year and a-half. From this it will be clearly seen that the duration of disability in fractures of the astragalus is much in excess of that in fractures of the os calcis, and the probable duration of disability will be an important factor in estimating the appropriate compensation for damage in these cases.

Other Factors Influencing Prognosis.—In examining these cases we have been struck by the frequency with which marked thickening is found in the region of the external malleolus and by the fact that it is the point to which many of them refer most of their pain. Thus, out of eighteen cases of fracture of the os calcis, in which our notes are complete on this point, we find that in twelve there was marked thickening in the region of the external malleolus (see Fig. 15), and in only three was the thickening marked beneath the internal malleolus. Gaupp ascribes this thickening to the forcing of fragments outward, because the foot is more or less

inverted at the time of the injury. It seems to us more reasonable to suppose it to be due to the anatomical arrangement of the bones, by which the force, transmitted directly downward, will be somewhat broken on the inner side by the anatomical position of the neck of the astragalus and its tendency to give, whereas, upon the outer side the force is exerted directly upon the body of the astragalus and transmitted to the os calcis. It may also be suggested that the lower position of the external malleolus and the smaller size of the depression on the outer side of the ankle make the fragments thus placed a greater source of obstruction to motion. In many cases the arrangement of the thickening is such as to suggest that the tip of the external malleolus was practically embedded in new-formed bone, and that there was an attempt at the formation of a false joint in this position, with accompanying pressure and pain. In one case, at least, removal of the overgrowth of bone in this position produced marked improvement in the symptoms and the foot was transformed from a bad to a good result (Fig. 16). We believe that more attention should be paid to this point and that more frequent resort to surgical intervention after the disability is fully developed will result in considerable improvement in many cases.

Compound Fractures.—As might be expected, the cases of compound fracture show a long period of disability. Infection is common, and complicated, as it is, by the proximity of many joints, makes it proper to classify this injury as a very serious one. In not a few reported cases amputation has ultimately been necessary and in most cases repeated operation only has resulted in cure.

Treatment.—Treatment may be divided into that applicable to fresh cases, and a discussion of what may be done to remedy the disability caused by old fractures which have either been improperly treated or in which serious disability has resulted in spite of the best of care.

Treatment of Fresh Cases.—The general principles of treatment do not essentially differ from those applicable to other fractures in this region. The foot should be elevated, and during the stage of acute swelling can be put up in a "pillow" splint or posterior wire splint in such a way that the bandages can be readily removed, the condition of the soft parts inspected, and ice-bags applied if necessary. Where the skin is threatened by a loose fragment, it must be carefully watched with a view to replacing or removing the fragment by operation before the vitality of the skin is too much lowered. After the swelling has considerably diminished—generally at the end of a week or ten days—an attempt may be made to improve the position if loose fragments are present. In impacted cases little but damage is likely to be done by manipulation, unless undertaken as the result of indications clearly shown in the X-ray plate, and by methods to be discussed in detail later. Except for the retention in position of loose fragments, and after operative interference, there is little necessity for immobilization in these cases, and the slavish adherence to this principle of the treatment of fractures is likely to increase rather than diminish the disability. In impacted cases, early massage and passive motion are to be strongly advised, though of course care must be taken to see that loosely-impacted fragments are not disturbed. The most common and serious error in treatment is to allow the patient to bear his weight upon the foot too early. We are entirely in accord with the opinion expressed by Nasse and Borchardt⁵ that these cases should bear no weight on the foot for at least sixty days. It is abundantly evident that the amount of callus in many cases is excessive and is an important cause of disability, and it seems reasonable to suppose that the amount of callus will be considerably increased by early use of the foot. On the other hand, massage and passive motion, by tending to preserve free movement in all the joints and prevent unnecessary adhesions, will have a marked effect in diminishing the disability. After the union is firm—that is, after a lapse of about sixty days—the use of the Zander apparatus as a supplement to

passive motion is of undoubted benefit. There remain, however, a considerable number of special considerations, based upon a thorough understanding of the nature of the fracture, which will influence the surgeon in the treatment to be adopted, and which must be considered in detail.

FRACTURES OF THE ASTRAGALUS.

Fractures of the neck.—I. Cases in which the anterior fragment, consisting generally of the head and neck, is more or less dislocated and threatens the skin, require prompt treatment. It is occasionally possible to reduce the dislocated fragment and free the skin from dangerous pressure. Where this can be done it may be satisfactory, but in many cases the reduction will be only partial, sufficient, indeed, to relieve the immediate danger of the skin, but entirely insufficient to lead to a good after-result. Where reduction is possible they come into the class to be considered in the next heading. Where reduction cannot be achieved, or where the vitality of the skin has been seriously compromised, immediate operation is to be advised. This should consist in a free, curved incision over the front and outer side of the ankle joint, which will give good access to the fragments. The annular ligament should be divided and tendons retracted to an extent sufficient to give thoroughly good access. If the anterior fragment is sufficiently shattered and torn from its attachments to seriously compromise its vitality, a better result will probably be obtained by its complete removal than by an attempt to restore it to an approximately normal position. If, on the other hand, the principal fragment is large and its blood-supply probably good, it may be replaced in its proper position and held either by suture or wiring. The number of cases in which replacement with suture has been attempted is too small to warrant conclusions, and, though it is an ideal method of treatment, it is proper to admit that excellent results are obtained after complete removal of the head and neck of the bone, and that the danger of bone necrosis, with or without infection, is much less.

It is unnecessary to add that such an operation must be attempted only under the very best conditions and with the strictest attention to asepsis.

2. *Fractures of the Neck with Rotation of the Posterior Fragment.*—This class is quite similar to the one just considered, except that as the skin is not threatened there is no indication for immediate intervention, and operation should not be undertaken until the swelling has subsided and the tissues are in a better condition. Reference to the illustrations will show, better than any description, the reasons for operation in these cases (Fig. 19). The results without operation are nearly uniformly bad. Great limitation of the ankle joint is the rule and is not likely to be exceeded by that resulting from operative failure. In short, it is hardly probable that the ultimate condition will be made worse, and there is the best reason for supposing that it will be greatly improved.

The end to be sought by operation is the restoration of the fragments to their previous position. The difficulty lies in the rather insufficient exposure by any incision at our command, and the difficulty of rotating the body or posterior fragment into a normal position and then holding it in contact with the anterior fragment. If this can be done in a reasonably satisfactory way it is to be preferred to the alternative of removing the anterior fragment, but the latter procedure has given excellent results. The choice between these two operations can probably not be made until the joint is freely opened and the position and motility of the parts have been accurately determined. The importance of operation can be determined by a critical examination of the X-ray plate, but not the exact operation which will give the best results.

3. *Fractures of the Body.*—Fractures of the body of the astragalus are commonly impacted and frequently complicated by impaction of the underlying portion of the os calcis (Fig. 22). Though the ultimate result is likely to be bad, and much loss of motion at the ankle joint frequently results, it does not

appear that operation is likely to improve the condition. In some cases, however, the fracture is not impacted, or, at least, is partially impacted, being complicated by loose fragments, particularly from the anterior portion of the body. These fragments are particularly likely to become fixed in such a position as to prevent dorsal flexion, and when such fragments exist their removal is indicated. It is, however, by no means easy to determine the looseness of such fragments, or, indeed, to definitely state their origin. In one of our cases a fragment lying in front of the body of the astragalus was removed, and was thought to have come from that bone, but a study of plates leaves us in considerable doubt as to its origin.

OS CALCIS.

1. *Small Loose Heel Fragments (the Avulsion Fracture).*

—These cases, which may be typified by Fig. 6, are best treated by operation. If left to nature, the convalescence is slow and a troublesome prominence over the heel is practically certain to result. The fragment is readily exposed by a curved incision and may be held in position by a nail or by suture or wiring, as suggested by Eisendrath.⁶ The simplicity of the operation and the practical certainty of a good result, if skillfully carried out, seem to make the indication clear.

Large Heel Fragments.—These cases open an interesting field for discussion of possible benefit which may result from active treatment. When treated expectantly the results are frequently far from satisfactory. The upward displacement of the heel fragment generally results in troublesome “flat foot,” and it is certainly possible that the condition may be improved by an attempt to improve the position. Carless⁷ has suggested the possibility of pulling down the fragment into its proper position, or even over-correcting the deformity after division of the tendo Achillis. We have ourselves in one case done this without knowledge of previous work, and the result has been sufficiently favorable to encourage us to make a

further attempt in this direction. In this instance, after subcutaneous tenotomy of the tendo Achillis, a large posterior fragment, which was partially impacted, was loosened, though with some difficulty, and its position apparently improved. The ultimate result has been considerably better than in most of the similar cases which we have seen. The difficulty in improving the position in this case came from inability to get a firm grip upon the heel fragment. This could be readily done by drilling two small holes on the sides of the heel fragment and inserting powerful hooks, such as those used by Porter,⁸ in elevating the head of the bone after fracture and dislocation of the head of the humerus. With this addition to the technic there seems to be no doubt that the fragment could be broken loose from its impaction and placed in an improved position. It would probably be wise to over-correct the deformity and make the arch of exaggerated height on account of the tendency of these fragments to work upward as the swelling goes down beneath the plaster. A snugly-fitting plaster-of-paris dressing seems the most appropriate method of retaining position in these cases. While our experience is entirely too limited to warrant the assertion that such a method is to be unhesitatingly advised, we feel that further research in this direction is much to be desired.

2. *Fissures—Comminution of the Anterior Half—Complete Comminution.*—In the treatment of fresh cases of these varieties it does not appear that anything but expectant treatment is justifiable. In case of fissure a good result is generally to be had by this method. In comminutions of the anterior half the resulting disability comes from flattening of the arch and from the lateral displacement of fragments, particularly to the outer side, which interfere with the lateral motions of the foot and cause pain. It is possible to improve somewhat the flattening of the arch by padding under a plaster bandage, and this should always be attempted. In the early stages it is impossible to estimate how much trouble the lateral fragments will cause, and active intervention is therefore best postponed

until union has taken place and any indication for interference can be more accurately mapped out. In the case of complete comminution the same reasons make it unwise to interfere, except for the relief of resulting disability.

Old Cases.—The surgeon is frequently called upon to decide what can be done to improve the results of old fractures, either of the astragalus or os calcis, which have either been wrongly diagnosed, improperly treated—particularly by too early use—or which have followed the most conscientious treatment. The chief complaints are of limitation of motion, pain, or faulty positions of the foot, with displacement of the normal weight-bearing line. Many of these cases can be improved, and we are inclined to feel that the tendency has been to over-conservatism, and that greater willingness to attempt operative relief will be followed by good results.

Old Fractures of the Astragalus.—In these cases there are two prominent indications for operation:

(1) Limitation of motion: This frequently follows fracture of the neck of the astragalus with faulty union, as shown in Fig. 20. Motion is likely to be very much limited, and may be practically nil. The two operations to be considered are partial, or complete, astragalectomy. In the partial operation only the head and neck of the bone are removed, and this is particularly applicable to cases of faulty union due to rotation of the posterior fragment. The resulting improvement in motion in these cases has been very encouraging. Where the disability is great, and removal of the anterior fragment does not relieve the condition (a situation particularly likely to occur where the body of the bone has been broken), complete astragalectomy should be seriously considered. The possibility of a worse result is not large and very great improvement has followed in some of the cases in which this has been done.

2. Cases of Valgus or Varus Deformity: Cases of fracture of the astragalus are particularly liable to the worst varieties of

pronated "flat foot." This is well illustrated by the case shown in Fig. 23. In this case, as in other similar ones, the amount of motion at the ankle joint was sufficiently good to make it improbable that it could be improved by operation. On the other hand, very great disability resulted from the position of the foot, and operation was indicated for the same reasons that it is to be advised in severe cases of rigid "flat foot." The operation most applicable is the osteotomy of Trendelenburg,⁹ in which the tibia is divided with an osteotome from side to side just above its articular surface, the chisel being manipulated so as to leave a V-shaped gap. The fibula is then divided at a similar level and the whole foot carried inward until the weight-bearing line is normal. The operation has been frequently done by the orthopedic surgeons for "flat foot" and with excellent results, but it is important not to over-correct the deformity as, there is little or no tendency of the bones to return to their former position, and it is entirely possible to convert a valgus into a varus foot by over-correction. Extended discussion of this point does not seem necessary, as the problem is essentially that of "flat foot."

Fractures of the Os Calcis.—These fractures do not present an attractive field for late operative interference. In those cases, however, in which there is excessive callus formation below the external malleolus, resulting in a painful foot, considerable relief may be expected. Whether this pain is due to pressure upon nerve filaments or simply to pressure of the lower end of the fibula against the new-formed bone, we are unable to decide, but the indication for the removal of such offending masses of bone seems to us clear, though it cannot be expected to influence, to any great extent, the motions of the foot. In many of these cases, however, pain rather than limitation of motion is the cause of disability, and where this is the case operation is practically certain to result in improvement.

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FIG. 1.—Fracture of the os calcis. This illustration shows well the amount of local swelling, the extent to which it is confined to the foot, and the lack of obvious deformity.



FIG. 2.—Fracture of the os calcis. Man, 40 years, fell ten feet, striking squarely upon both heels, on the ground.

X-ray shows fracture of the os calcis of the large heel fragment type.

This is a favorable case for tenotomy of the tendo Achillis and reduction of the posterior fragment, with restoration of the arch.

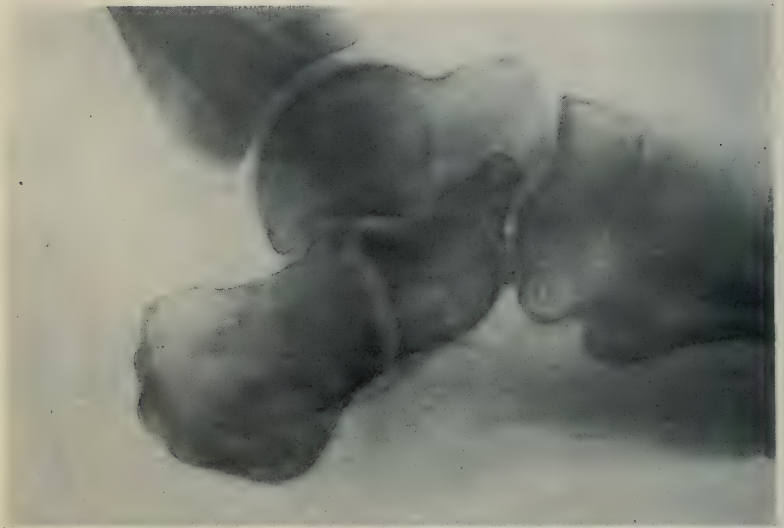


FIG. 3.—Fracture of the os calcis. This patient, a man, fell 15 feet on to frozen ground, striking upon both feet, in February, 1899. Right heel showed abnormal mobility and crepitus over the os calcis. X-ray shows comminuted fracture with large heel fragment. Treated with pillow splint; later, plaster of Paris bandage.

May, 1895. Has some pain through ankle joint. Always wears an insole. Is considerably hindered about his work. Examination, right foot: Considerable bony overgrowth beneath external malleolus. Motions: No flexion beyond right angle. No adduction. Very little abduction. Fair extension. Good position. Longitudinal arch, fair. Classed as fair result.

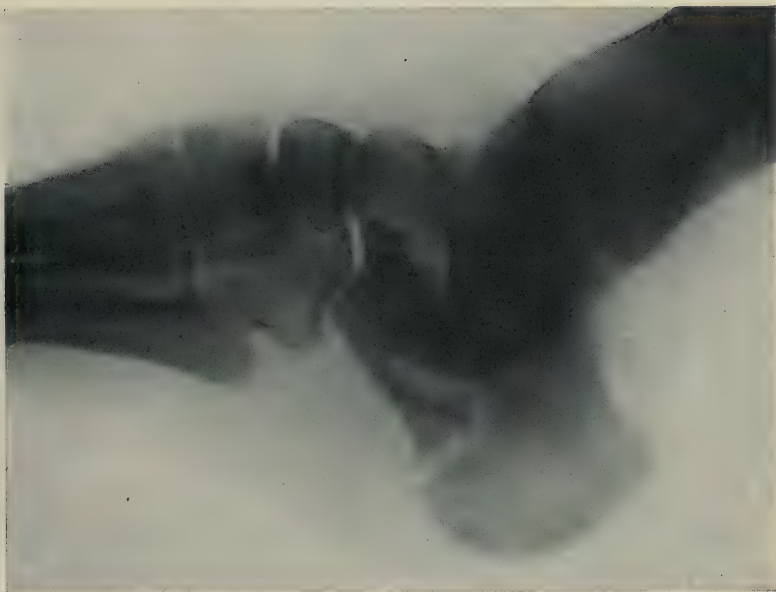


FIG. 4.—Fracture of the os calcis. Man, 26, fell from moving car, striking left foot against tie. In May, 1899, X-ray shows fracture of os calcis, large heel fragment type, with tendency of posterior fragment to be drawn upward. Plaster of Paris bandage.

June, 1905.—Reports returned to work after three and a half months. Very little trouble at any time. Foot becomes tired after long day's work. Present condition, slight fulness beneath external malleolus. Extension good. Flexion slightly limited. Very little lateral motion. No "flat foot." Classified as good result.



FIG. 5.—Fracture of the os calcis. Shows same foot as Fig. 4, six years after injury. Note great thickening of central portion of os calcis with fusion of astragalo-calcaneal joint.



FIG. 6.—Fracture of the os calcis. A beautiful example of small heel fragment type of fracture—the avulsion fracture of other authors.

Fracture caused by slipping while getting on a street car, apparently by sudden contraction of muscles of calf. Operation refused. Result unknown.



FIG. 7.—Fracture of the os calcis (left). Man, 44, fell ten feet to the ground, striking on both feet.

November, 1899. X-ray shows fracture of both ossa calcis of fissure type. Treated, plaster of Paris bandage.

May, 1905. Reports returned to work after six months. At first considerable pain in walking; now only in bad weather. Some soreness under instep, troublesome when climbing ladder. Examination of left foot showed practically no adduction or abduction. Flexion and extension good. Foot very flat and slightly pronated. Classified as fair result.



FIG. 8.—Fracture of the os calcis. X-ray shows right foot of patient whose left foot is illustrated in Fig. 7. Examination, May, 1905, showed some irregular thickening in front and below malleoli. All motions free. Considerable "flat foot." Weight-bearing line normal.



FIG. 9.—Fracture of the os calcis. Shows condition of right foot of patient described under Fig. 7, six years after injury. Note practical return to normal. Classified as good result.



FIG. 10.—Fracture of the os calcis. Shows type of fracture described as comminution of anterior half of os calcis. Result unknown.



FIG. 11.—Fracture of the os calcis. Shows another type of comminuted fracture of the anterior half of the os calcis. Note great flattening of longitudinal arch. Result unknown.



FIG. 12.—Fracture of the os calcis (right).



FIG. 13.—Fracture of os calcis (left). Figs. 12 and 13 show the injury resulting to a man of 26 who fell thirty feet to the ground, striking upon both feet. On the right side the injury was compound. They represent the worst type of comminuted fracture of the os calcis. Classified as "completely comminuted;" injury too recent to show result.



FIG. 14.—Fracture of both ossa calcis (lateral view).

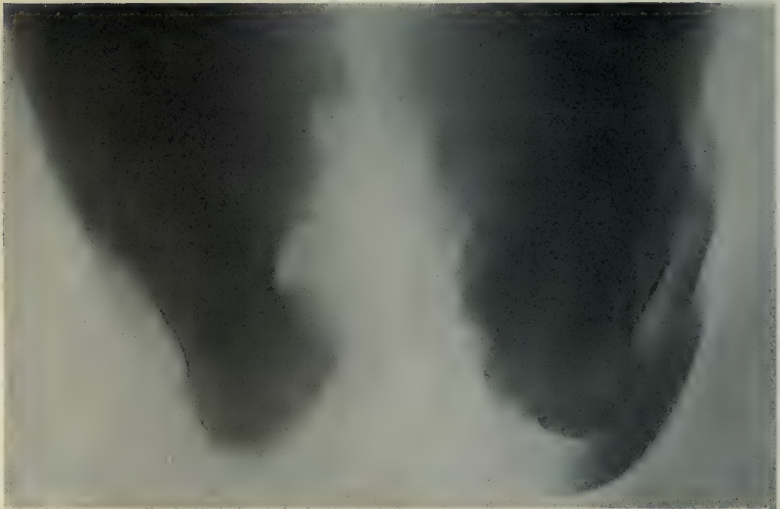


FIG. 15.—Fracture of ossa calcis. (Seen from above downward.) Figs. 14 and 15 show the condition six years after injury from fall of twenty feet on to concrete floor. In May, 1905, left foot shows much thickening below external malleolus. Longitudinal arch obliterated. Rigid pronated foot. Bad result. Right foot: Marked thickening to outer side of tendo Achillis. All motions good. Very little "flat foot." Good result.

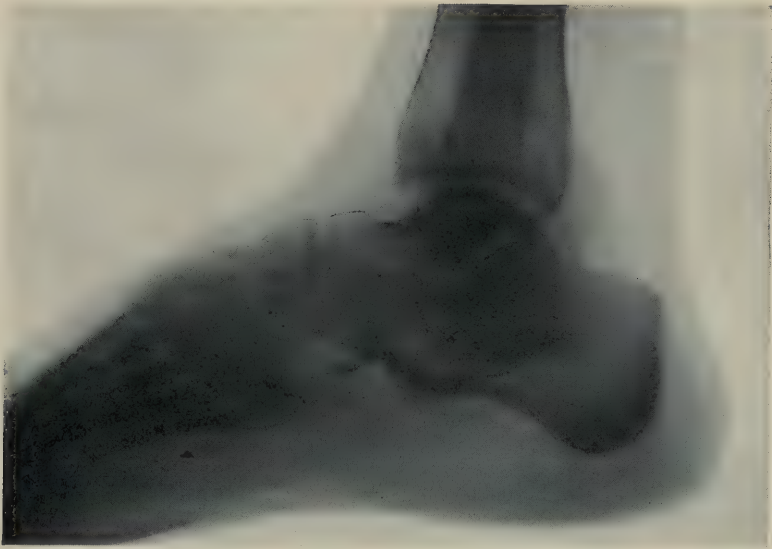


FIG. 16.—Fracture of os calcis. The astragalus is here driven down into os calcis, lowering ankle joint. Eight months after injury: painful foot, much thickening under external malleolus, no lateral motion, limited flexion and extension. Bad result. Operation by Dr. Goldthwaite. Removal of bony overgrowth beneath external malleolus. Now useful foot.



FIG. 17.—Os trigonum. In cases of injury this is frequently mistaken for a chip from the astragalus.

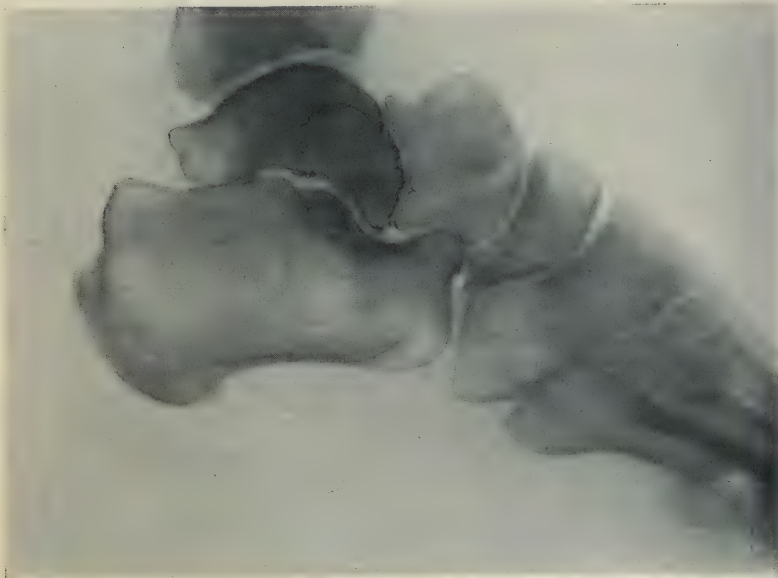


FIG. 18.—Fracture of the astragalus. Patient fell ten feet to ground, September, 1900. "Sprained ankle." X-ray, fracture of neck of right astragalus.

March, 1901. Bad result. Useless foot. Partial ankylosis. Partial astragalectomy, Dr. Brooks.

May, 1905. Foot slightly inverted, longitudinal arch raised, no lateral motion, no flexion, 10 degrees of extension. Painful foot. Bad result.



FIG. 19.—Fracture of astragalus. Fracture due to direct violence, from heavy bar falling on foot. May, 1904. Plaster of Paris bandage.

July 4. Trendelenburg osteotomy, Carney Hospital.

May, 1905. Painful foot. Forward displacement of foot on leg. Exaggerated longitudinal arch. Deformity not wholly corrected by operation. Marked inversion. Flexion good. Extension limited. Lateral motions limited. Bad result.



FIG. 20.—Fracture of astragalus. Foot run over by heavy team, February, 1902. Treated by natural bone setter. X-ray shows fracture of neck of astragalus. Operation advised and refused.

September, 1905. Painful foot. Much inversion, large bony fragment on dorsum (head of astragalus). Flexion fair. Extension poor. No lateral motion. Foot very flat. Bad result.



FIG. 21.—Fracture of astragalus. X-ray shows impaction of astragalus, especially in central portion, with lowering of ankle joint.



FIG. 22.—Fracture of astragalus. X-ray of right foot of patient shown in Figs. 23 and 24; impacted fracture of astragalus with lowering of ankle joint. Marked eversion.



FIG. 23.—Fracture of astragalus. Note marked eversion with displacement of weight-bearing line, showing indications for Trendelenburg osteotomy.



FIG. 24.—Same patient after osteotomy. Weight-bearing line partially restored. Foot converted from a poor to a good result. Now walks without discomfort or limp.

OLD FRACTURE OF THE TARSUS.

WITH A REPORT OF SEVENTEEN CASES.*

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IN many cases of fracture of the astragalus or of the calcaneum the nature of the lesion is apparently not recognized at the time of its occurrence. Many of the patients are treated for sprain or contusion, or for fracture of the malleoli. Later their condition is often thought to be due to rheumatism.

REVIEW OF CASES OF FRACTURE OF THE CALCANEUM AND OF THE ASTRAGALUS.

Hippocrates described tear fracture of the calcaneum, and said that, when improperly treated, it often resulted in gangrene. Theodoricus, in 1546, and others following him, denied that the calcaneum was ever fractured: "Calcaneus non fragitur, quia os durum est et protectum ligamentis." "Nullo pacto calcis accidit fractura." Norris, in 1839, published the results of an autopsy on a patient who had fractured the anterior processes of both his calcanea by jumping in delirium from a third story window. Malgaigne, however, seems to have been the first to describe accurately this form of fracture by crushing force, giving it the name of "fracture par écrasement." Abel, reporting in 1878 three cases of fracture of the sustentaculum tali by direct violence, was surprised to find that he was almost a pioneer in the subject. Fractures of the anterior part of the bone are hidden from sight and from touch. This, he thinks, is the reason why they have for centuries passed unnoticed, while tear fractures of the posterior part have been recognized.

*Read at the annual meeting of the American Orthopædic Association, Toronto, August 21, 1906.

Since 1878 many cases of fracture of the astragalus and of the calcaneum have been reported, so many, indeed, that, unlike Abel, one is surprised at the great number of workers in the field. A study of the views of various writers lets in the light on what has been an obscure subject, and seems to point the way to a more successful treatment of these injuries.

Norris¹ reports a case of a man of thirty-five, who jumped from a window while drunk. Gangrene followed, and death. The autopsy revealed "fracture of the calcaneum in two places in its anterior part." There was no displacement. The author says that it was remarkable that the most certain diagnostic sign of this accident, the drawing up of the posterior fragment by the tendo Achillis, was absent.

Abel² appears to have been the first to recognize the importance and frequency of crush fractures of the calcaneum, and reports three cases of fracture of the sustentaculum tali, one being compound. This last case went to autopsy. Abel gives three symptoms as characteristic: First, broadening of the heel, Second, flattening of the foot and sinking of the malleoli, especially of the inner. This is due to the fact that the breaking off of the sustentaculum tali deprives the foot of its support on the inner side. Third, immediate pain and disability. Usually the disability is so great that the patient is unable to walk a step. If in an ordinary crush fracture the fragments are much impacted, the immediate disability is not so great. The author says that most of these fractures are treated for fracture of the leg bones, or for sprains.

Bailey's³ case of fracture of the calcaneum is more or less doubtful. The patient, a farmer of forty years, had his foot caught between the table of a threshing machine and a wagon. From the description of the case one suspects fracture of the astragalus. The treatment consisted of rest on a pillow, with no splint. One year after the injury motion was limited at the ankle.

Goyder's⁴ case was a compound comminuted fracture of the astragalus, with protrusion of the external malleolus. The foot was in inversion. Through the wound the author removed the astragalus, which had been broken into numerous fragments. The foot was put up in splints and the patient recovered with a movable ankle and a useful foot. Four and one-half years afterward the foot was shorter and narrower than the other. The patient could not bear his whole weight upon the front part of it, and, in walking, planted it squarely on the ground.

Bell⁵ reports two cases of compound fracture of the calcaneum both caused by a fall on the feet. Nothing is said as to the amount of resulting disability, nor of the symptoms. In one case, "the bone was completely pulverized."

Van Buren⁶ presented a specimen of a calcaneum which had been excised for caries following a comminuted fracture of the anterior portion,

several weeks before. The patient had been blown up by a blast, and landed squarely on his feet when he descended. Several months later the patient was about on crutches. This was the last note on the case.

Stimson⁷ showed a specimen of an old fracture of the calcaneum. The injury had taken place eight years before, probably as the result of muscular action, and the bone had united in a bad position.

Whitman⁸ reports a case of a double fracture of the calcaneum, compound on the right side, which was caused by a fall of eighteen feet. Death followed on the twelfth day from pulmonary embolism. The autopsy showed the following: "Fracture of inner aspect of right os calcis immediately below the articulation with the astragalus" (*sustentaculum tali*?). Left side, "Os calcis . . . completely smashed. The superior surface . . . firmly impacted into the surface to which the tendo Achillis is attached. This portion of the bone was also fractured in various directions. . . . The remainder of the bone was broken into several fragments."

Bishop⁹ published a case of a painter, thirty-four years old, who jumped from a ladder to the ground as the ladder slipped, a distance of thirty-six feet, and fractured his astragalus, external malleolus and cuboid. The foot was in inversion, and seemed shortened on its inner border. Part of the astragalus was dislocated on the outer side of the dorsum of the foot. The deformity was reduced under chloroform. On the eighteenth day the patient died of pneumonia. The autopsy showed the following: "The astragalus was divided into two main portions by a fracture which passed obliquely backwards and inwards, and from above downwards and forwards, along the line of the interosseous ligament, which was utterly destroyed." Part of the external lateral ligament had been torn, as well as some of the other ligaments of the foot.

Humphry's¹⁰ patient was a boy of sixteen years, who fell sixteen feet on his left foot, and fractured his astragalus. A portion of the astragalus was dislocated and could be felt beneath the skin "on the left side of the dorsum." This was reduced under chloroform with difficulty and the foot was put up in splints. After two weeks the dislocation gradually returned and caused a small slough of the skin. Chloroform was again administered, the wound was enlarged, and the displaced fragment was removed. The fragment consisted of one-half of the astragalus which had been separated by a longitudinal fracture transversing the middle of the bone. Humphry does not say what was the end result.

Gussenbauer¹¹ reported a tear fracture of the calcaneum. He says that fractures from this cause are very rare. He nailed the fragment on to the body of the bone, and secured a good result.

Stimson¹² in 1888 gave the results of autopsy on a case of fracture of the os calcis and scaphoid. The patient was an adult male of thirty years who jumped in delirium tremens from a height of thirty feet.

Gilchreest¹³ in the same year, reported two cases, one of fracture of the calcaneum from crushing between freight cars, one of fracture of the internal cuneiform. Both fractures were compound and were operated upon with good results.

Beeson¹⁴ described three cases of compound fracture of the astragalus, two caused by a fall on the feet, one by a blow from a mass of iron. In all three the bone was broken into a number of pieces. Beeson removed the fragments and treated the wound by drainage. The first two cases ended in amputation. The third was under treatment at the time the report was made, but looked as if it would end in the same way.

Reed¹⁵ gives the history of four cases of fracture of the astragalus with displaced fragments, which were treated conservatively. In three of the cases the results were bad, in one, good. In all, the injury had been produced by a fall on the foot.

Betts¹⁶ showed a photograph of a calcaneum which he had removed from a painter. The patient had fallen about fifteen feet and landed on his feet on a stone sidewalk. He was treated for ten days under a diagnosis of sprained ankle. At the end of that time, when Betts first saw him, the foot had become infected. Final amputation was done to save the patient's life. Although the photograph is not very distinct, the case would appear from the author's description to be an impacted fracture.

Bähr¹⁷ described ten cases of compression fracture of the calcaneum, all with the same cause, a fall from a height. The diagnosis, of course, was without the X-ray. Bähr says that the characteristic symptoms of recent fracture are (1) swelling under the ankle; (2) sensitiveness over the calcaneum; (3) restriction of motion at mid-tarsal joint; (4) great pain on walking, usually located under the external malleolus and anterior to it; (5) slow recovery. The motions of flexion and extension at the ankle are free, but supination and pronation, and abduction and adduction are painful and restricted. The foot may or may not be flattened; the calcaneum may or may not be thickened and the malleoli sunk, depending upon the amount of crushing. The author considers that the fractures of the sustentaculum tali reported by Abel are rarities. The part of bone broken depends upon the position that the foot is in. Bähr advocates, in closed fractures, plaster of Paris left on for a long time. He thinks walking should not be allowed for two months. It is a mistake to put the weight of the body on the crushed, soft bone. Afterwards, massage and active and passive motion may be tried. All stiff parts are useless and painful. Bähr thinks the flat foot is of little moment. The pain is due to the weight of the body upon the distorted bone, often not fully hardened, and is especially severe where a sprain has been diagnosed, and the patient urged to walk early. Prognosis as to complete recovery is bad. Bähr reaches three conclusions: First, fractures of the calcaneum are more frequent than has been thought. Second, they are usually unrecognized and are treated as sprains, fractures of the malleoli, etc. Third, they usually cause a prolonged disability, often of a severe grade.

Bähr¹⁸ also reported a case of old fracture of the right calcaneum. Operation was done on account of a painful swelling in the heel which was diagnosed as a bunion. A piece of bone was chiselled off, with good results.

Jones¹⁹ described an old fracture of the astragalus and calcaneum

in a patient who had fallen from a height of thirty feet, landing on his feet. The injury was followed by immediate pain. The diagnosis had been sprain of the ankle.

Ehret²⁰ in a paper published in 1896, states that of the 2016 patients treated at his institute, 47, or $2\frac{1}{3}$ per cent., had fracture of the calcaneum. Of these 47 only three came with the correct diagnosis. Thirty were of the left foot, thirteen of the right, and four of both. When the right alone was broken, the injury was distinctly of that foot. When the fall was upon both feet, the right was never broken alone, but the left was broken, or both. The stubbornness of the symptoms is marked. Only five patients were discharged completely well, and these were young. The cause is a direct blow or a fall on the feet, usually the latter. The fracture is always caused by an involuntary jump or fall, never when the patient jumps down naturally, for then he probably catches a large part of his weight on the front of his sole. The fall was always from a height, never a fall over on the level. There is no relation between the height of fall and the intensity of the fracture. Ehret has never seen a pure tear fracture, though he thinks the pulling of the muscles, fasciæ, and ligaments, plays a strong part in the crush fractures. He divides all fractures into those of the body and those of the processes. Immediate disability is not invariable. Dorsal and plantar flexion may not be limited. Abduction and adduction, and pronation and supination almost always are limited, because these motions take place between the calcaneum and the astragalus, scaphoid, and cuboid. The gait is characteristic, the foot being held immovable. The patient walks always on the same part of the sole. Ehret did not notice that the patient walks on inner border, but thinks he often walks on outer. The swelling is mostly about ankles and dorsum. There is thickening about the heels and filling in at the sides of the tendo Achillis. The author lays special weight on palpation. The outer side of the bone suffers most of the crushing, because the foot on the inner side can give way, whereas on the outer side it is rigid. When the body is weighted the inner ankle sinks (Sourier and Abel). Hence after fracture the external malleolus is nearer the ground. If both sink, the outer sinks more. The foot is always flattened because one of the most important stones of the arch is injured, and yet it is supinated. More than one-half of the author's patients were flat-footed before the injury. Foot clonus is present in about one-half of the cases. Calf cramps are frequent at night, and atrophy of the calf takes place. The diagnosis is made on five points: First, cause: usually fall on sole. Second: restriction of abduction and adduction, with peculiar gait. Third: change in the contour of the heel. Fourth: broadening of the heel. Fifth: flattening of the foot. The patient must not be permitted to walk too soon, for fear of injuring the bone further. Massage, electricity, baths, gymnastics, and shoes are recommended. The restriction of supination and pronation causes most of the resulting disability. By operation any loose pieces of bone can be removed, as also the retro-Achilles bursa.

Joy²¹ reported a tear fracture of the calcaneum plus comminution,

received by an intentional fall on the feet. Open operation with tenotomy was performed, but nothing is stated as to the end result.

Golebiewski²² described a case of fracture of the scaphoid, astragalus, and calcaneum, caused by the attempt of a hod-carrier to go up a ladder in his bare feet with a heavy weight on his shoulder. In this case the diagnosis was probably wrong, as no fracture of the calcaneum appears in the skiagram. Palliative treatment attained a fair result.

Neuschäfer²³ published a case of pure tear fracture of a large piece of the calcaneum. Tenotomy did not avail to reduce the dislocated fragment. An incision was then made over the heel, and the fragment was sewn in place. The foot was put up in plaster, in strong equinus, and union was uneventful. Three and one-half months later the patient walked without a stick.

Vollbrecht²⁴ reported two cases of fracture of the astragalus. The patients were adult males. One sustained his injury by a fall from a horse; the other by a kick from a horse. One had been diagnosed sprain, and the other contusion.

Carless and Mayon²⁵ find that many of these cases of fracture of the calcaneum do badly if left to themselves. The resulting pain is due to depression of the astragalus and to formation of a large mass of callus under the calcaneum. Treatment is "somewhat unsatisfactory." In the early stages evaporating lotions are recommended. If, after swelling has subsided, the foot is in a bad posture it should be twisted back under an anæsthetic, and plaster of Paris should be applied. In an old standing case with much deformity and pain a wedge of bone may be removed, or the head of the astragalus may be excised, or even the entire astragalus.

Raven²⁶ reported a case of fracture of the astragalus and possibly also of the calcaneum (compare with Urban's³⁵ case). The patient was a male, aged seventeen, a waiter, who had fallen ten feet, landing on his left heel. Great swelling of the left foot and ankle were present. The foot was displaced inward and was inverted. There was crepitus below the internal malleolus, and a small bony movable mass could be felt. In a few hours all physical signs were obscured by the swelling. After a week's rest the deformity was partly reduced under anæsthetic, and plaster of Paris was applied. Eight weeks later the patient had a fair amount of motion and could walk fairly well. The foot still remained much thickened.

Vegas²⁷ published a case of fracture of the astragalus in a boy of twelve who was thrown from a horse, and had been in plaster of Paris for forty days before Vegas saw him. The foot was inverted, and motion at the ankle was restricted. Excision of the astragalus gave a good result. The writer maintained that these fractures were rare.

Bennett²⁸ describes a case of fracture of the astragalus, which he thinks was probably caused by a blow. The specimen was obtained from the dissecting room and was without history. There was a single line of fracture without displacement, which had united.

Villard²⁹ gave the result of an excision in a case of old fracture of

the astragalus. His patient walked without fatigue or limp and the equilibrium of his foot was perfect.

Galavielle's³⁰ case of fracture of the astragalus was evidently a linear fracture without much displacement. The patient was thrown to the ground and could not rise. There was great immediate disability. One year after the injury, flexion, extension, and lateral movements were limited. The author says that fracture of the astragalus is frequent, and is caused by direct or indirect violence. Usually it is not accompanied by displacement, and heals early and rapidly.

Heger³¹ described three cases of fracture of the calcaneum, one a tear fracture, two crush fractures. The treatment of crush fracture recommended is by plaster of Paris. Union is hard to obtain.

Destot³² reports three cases of fracture of the calcaneum, two of them recent, and two cases of fracture of the inferior extremity of the tibia and of the astragalus. All were caused by falls on the feet from a height of two to five meters. In only one case of fracture of the calcaneum was the bone badly splintered, and in this case the prognosis was better than in the others. In one case there was very little deformity and the foot was not flattened. The two fractures of the astragalus were almost exactly alike, one being two and the other twenty months old. In both the foot was in varus, and the tibio-tarsal joint was ankylosed. A piece of bone four cm. long was torn from the anterior aspect of the tibia, and the foot was subluxated forward, giving it an elongated appearance. The hollows behind the malleoli were effaced, and those below the malleoli were partly so. Both patients had a permanent deformity which would diminish in time, but at the end of twenty months one patient walked with difficulty and used a cane. He was incapacitated for work. Resection of the astragalus was the only remedy to be advised for these patients.

Destot³³ also reported a case of old fracture of the astragalus in a man of thirty-five years, who fell about three feet, and was for five months treated for sprain. During this time the patient's condition had not improved. The author inclined to resection, but the patient would not permit it. The prognosis of these fractures of the astragalus differs according to the location of the fracture and the displacement of the fragments. They are all apt to be very tedious. If one articular surface of the bone is involved, the prognosis is worse than if both are. Destot propounds the question whether it would not be better in fracture of the astragalus, realizing the tediousness and long duration of the symptoms, to do an excision at the time of injury, rather than to wait for a year or two and then probably be obliged to do the operation.

Morgan³⁴ published a case of fracture of the astragalus with displacement of the posterior half, caused by a severe blow upon the thigh while the knee was flexed. Nothing as to treatment or result was given.

Urban's³⁵ case of fracture of the astragalus with dislocation backward of the posterior half, was in a glazier of fifty years of age, who fell from a height of twenty feet. The posterior part of the bone was dislocated. The tibia was forced through the fragments and rested on the

calcaneum. No exterior wound was present. The fragments could not be replaced even under an anæsthetic. Urban therefore laid bare the ankle by an incision on the inner side, divided the three tendons on the inner side of the foot, chiselled off the lower part of the inner malleolus, turned it down with the deltoid ligament, and brought the fragments of the astragalus into position. The tendons were then sewn, the malleolus brought into its proper place, the wound was closed, and plaster of Paris was applied. The results were excellent, the patient walking without the plaster in the sixth week. Urban says that with dislocation or fracture of the astragalus, the bone or fragment must be put in its proper place even if an extensive operation be necessary. The removal of the astragalus should rarely be done.

Neuhaus³⁶ reported eleven fractures of the calcaneum, ten apparently from fall on the feet, one a gun-shot fracture. The prognosis depends on the amount of damage to the bone. If the bone is badly crushed and the fragments are dislocated, the prognosis is bad; otherwise it is good. For treatment he recommends baths, massage, and exercise.

In Berard's case³⁷ of old fracture of the internal malleolus, etc., the injury had been caused by the fall of a heavy weight on the foot fifteen years previously. The patient had gone to work ten days later and but little deformity was then present. Two years afterward an abscess appeared at the site of the old wound. The description of this case leads one to doubt the correctness of the diagnosis. The bones of the tarsus were united in a solid mass, their outlines were lost, and they were hypertrophied and deformed. Rarifying osteitis was present in the posterior tarsal bones. The bone disease was accompanied by ulceration of the skin, club foot, ascending neuritis of the post-tibial nerve, and by severe trophic disturbance. The author himself seems uncertain as to the correctness of his diagnosis. The treatment was amputation!

Bouchet³⁸ reports a case of crush fracture of the calcanea with the classical symptoms. The patient fell from the third story, landing on his feet. Under chloroform an unsuccessful attempt was made to replace the fragments. The author recommends lateral pressure under anæsthesia to reduce the fractures. He considers that the symptoms following them are largely due to compression of the nerves and vessels under the bone.

Rollet³⁹ in 1904 published the report of a case of fracture of both calcanea. The patient was a mason, thirty-two years of age, who fell from the second floor, landing on his feet. The two ankles were said to have been forced into the bony masses which lapped over on the sides, and posteriorly the axes of the astragali were changed so that their heads, instead of looking forward and downward, looked forward and upward. The body of the astragalus was forced into the body of the calcaneum. The results were given as follows: First: the patient supports his weight on a heel composed of broken splinters of bone. Second: the mid-tarsal joint is opened up and is kept in a state of inflammation. Third: the arch of the foot is depressed.

Eisendrath⁴⁰ has recently published a case of tear fracture; the treatment consisted of suturing with kangaroo tendon.

In many of the above reviewed cases in which no X-ray photographs were taken, the diagnosis would seem to have been based upon conjecture and supposition rather than upon certainty.

Author's Cases.—Judging from the history of the author's cases, seventy-six per cent. of them had been improperly diagnosed at the time of injury. Fifteen of the patients were men, one was a woman, one, a boy of fifteen. Six had a fracture of the left calcaneum, five of the right, one of both calcanea. Three had a fracture of the right astragalus, one of the left. One patient, the woman, had a fracture of both calcanea and of the left astragalus. Two of the fractures of the astragalus, and one of those of the calcaneum, were associated with a fracture of the tibia.

The history was the same in every case. All the patients had fallen from a height, usually greater than ten feet. They had been carried to their homes or to the hospital, and had been confined to their rooms from three to six weeks or more, those with fracture of the astragalus being disabled usually for a somewhat longer time than those with fracture of the calcaneum. In three other cases, which presented some of the symptoms of tarsal fracture, and which were at first regarded as possible cases, the usual history of a fall from a height, with extreme immediate disability could not be obtained. One was probably a case of syphilitic periosteitis; one was a bruise, and the other was a severe sprain. In Case II the patient gave a history of being struck by a barrel, only mentioning the fall on his feet when he was closely questioned. Case V. was treated at first with a wrong diagnosis. This patient also admitted afterward the fall on his feet. Numerous authors have taught that fracture of the calcaneum can be caused by muscular action, and that the bones of the tarsus can be fractured by various kinds of direct violence; and they are undoubtedly correct. But, on the other hand, it may be said that if a man falls from a height and lands on his feet, and if he is then unable to walk home and is confined to

his bed with great pain and swelling in his heels and in his ankles, a strong presumption, at least, of fracture of the calcaneum or of the astragalus is justified. If the patient be seen for the first time several months afterward and, besides giving the characteristic history, says also that he was confined to his bed for a month or two, and has since suffered from pain and stiffness in his heel or in his ankle; it is possible to tell almost with certainty, before he takes off his shoes, that he has a tarsal fracture. It is a great mistake to regard these fractures as rarities. They are, on the contrary, very frequent, and doubtless are responsible for much of the odium that attaches to a sprained ankle.

Cases VIII and XVII were seen at the Ruptured and Crippled Hospital; all the other cases at the Roosevelt Hospital, O. P. D.

Case I.—John Daly, aged fifteen, a schoolboy. Old fracture of left tibia and calcaneum. The patient fell about two months ago from a height of four stories, and landed on his feet. He was carried to the hospital and was confined there for six weeks. Examination shows old united fracture about two inches above the lower end of tibia, abduction of the heel, thickening about the calcaneum, and obliteration of the concavities under the malleoli. Treatment, strapping.

The X-ray shows probable fracture of sustentaculum tali.

Case II.—Thomas Breese, aged forty-nine, a carpenter. Old fracture of right calcaneum. Four months ago the patient "sprained" his right ankle by a fall on his feet from a height of twelve feet. He was carried in an ambulance to the hospital, and was confined there for three weeks. Since then he has suffered from pain and stiffness in his right foot. Examination shows the heel in peculiar abduction. The normal concavities under the malleoli are not present. The calcaneum is thickened.

The skiagram (Fig. 1) shows a probable fracture of the sustentaculum tali.

Case III.—Thomas Lacey, aged sixty years, a driver. Old fracture of the right calcaneum. Four weeks ago the patient jumped from a truck and hurt his right ankle. He reached

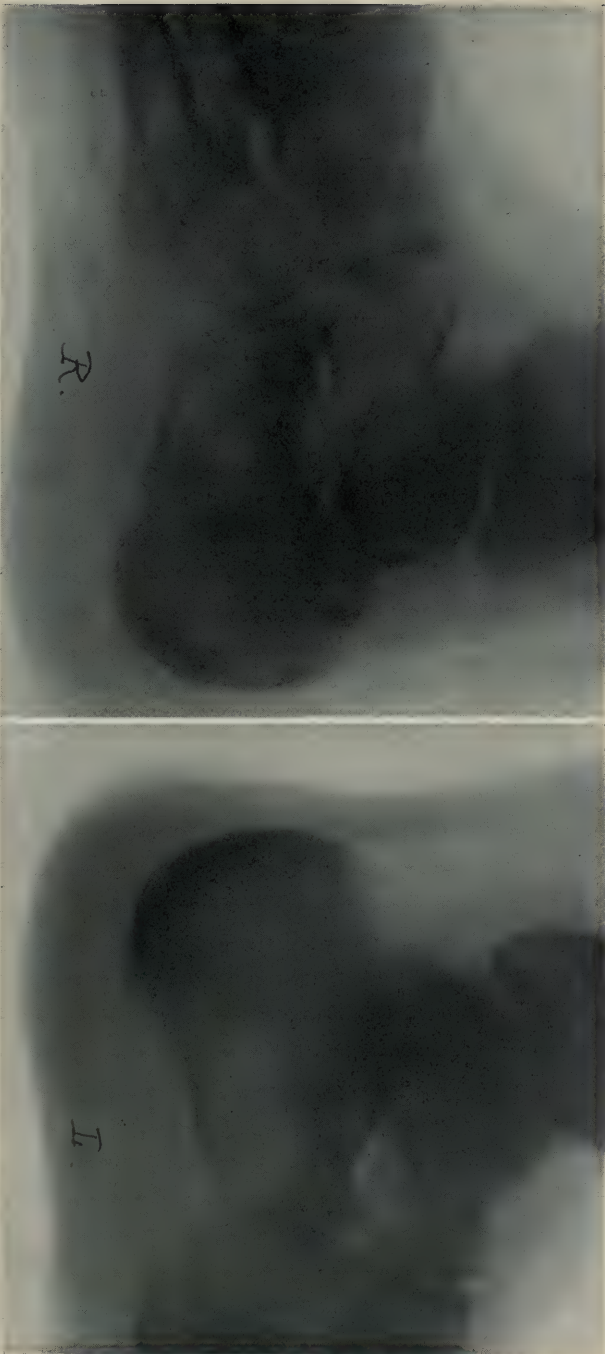


FIG. 1.—Old fracture of right calcaneum. See Case II. Normal bones of left tarsus shown for purpose of comparison.

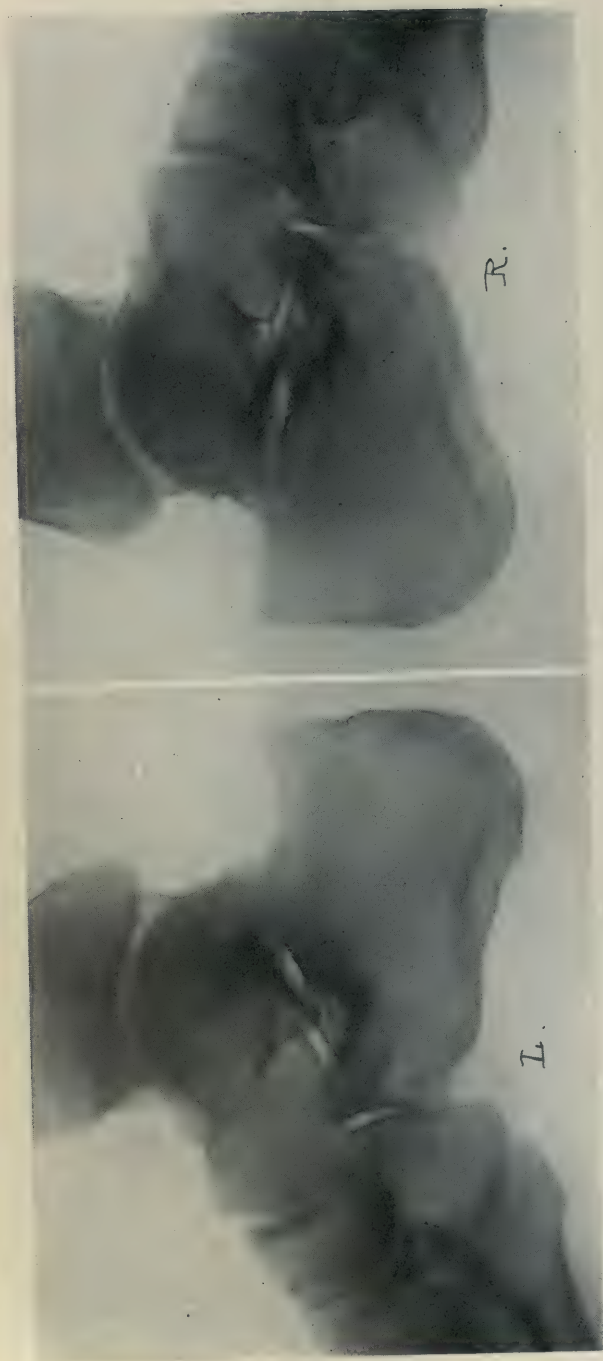


FIG. 2.—Old fracture of right astragalus and calcaneum. See Case III Normal bones of left tarsus shown for purpose of comparison.

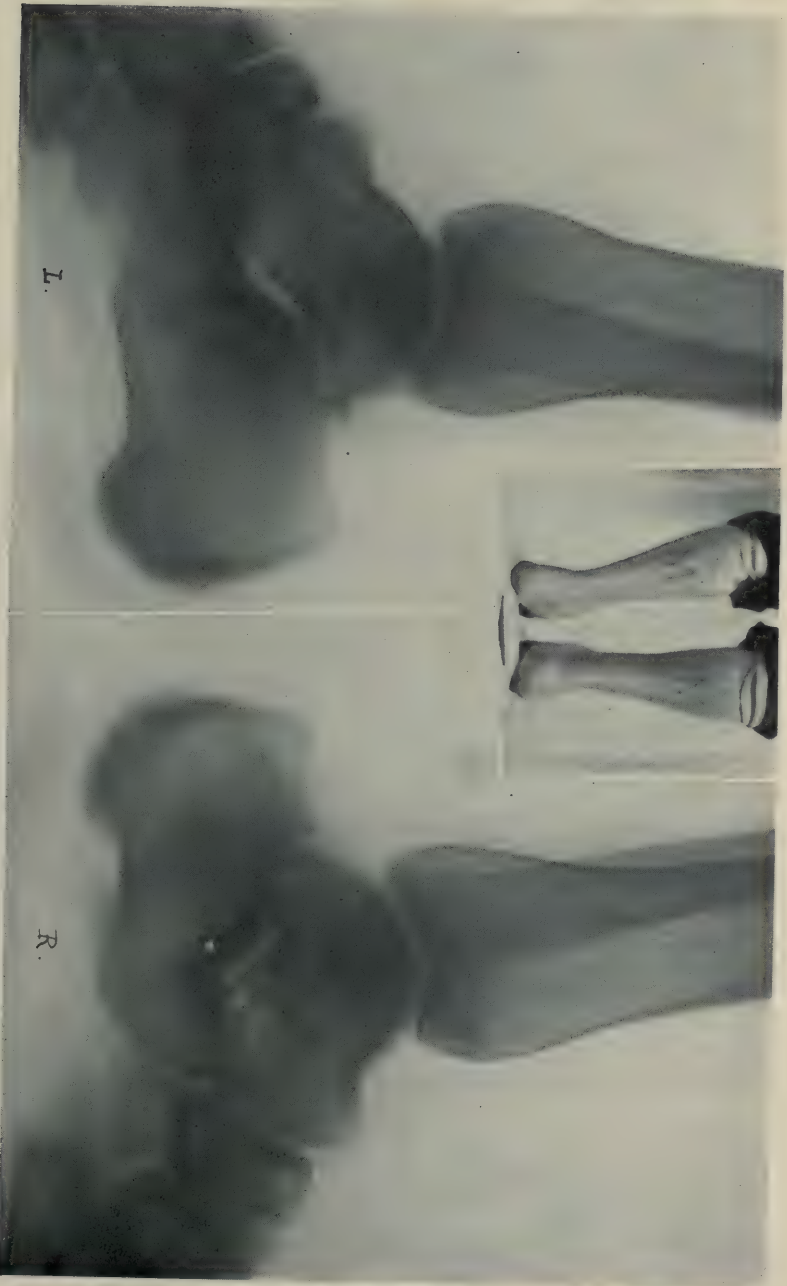


Fig. 3.—Old fracture of both calcanea. See Case IV.

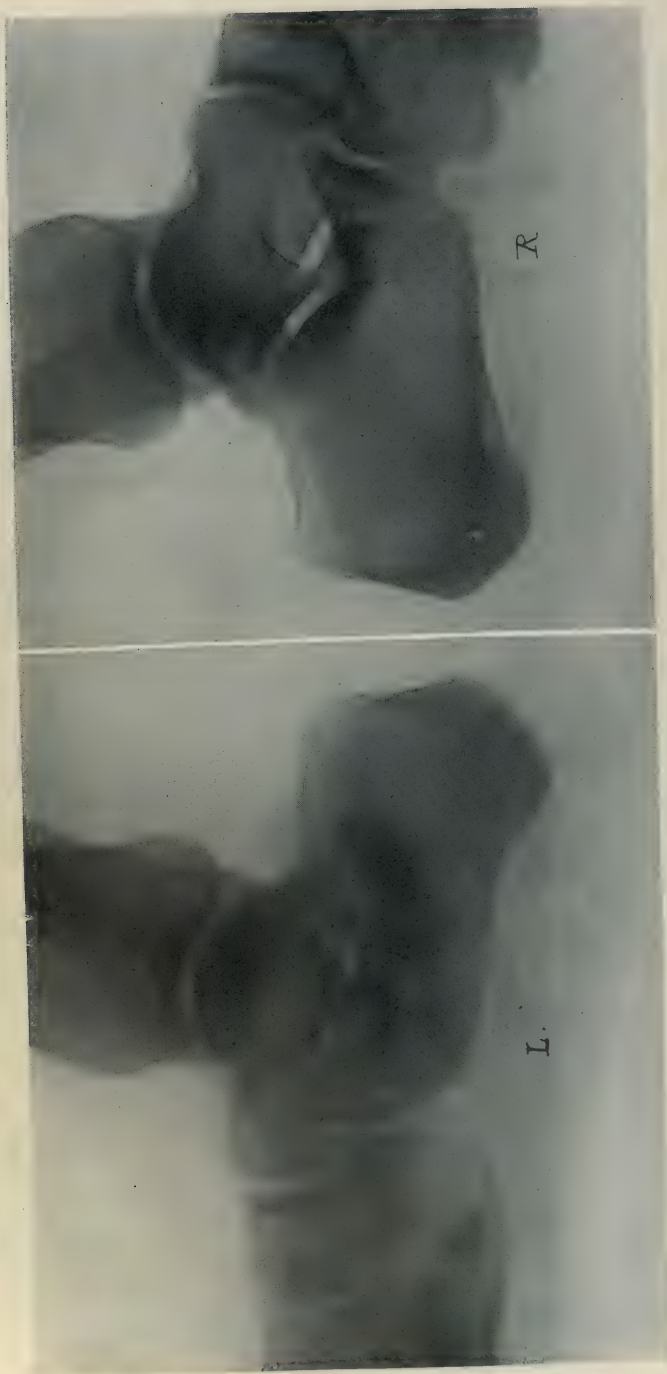


FIG. 4.—Old fracture of left calcaneum. See Case VII. Normal bones of right tarsus shown for purpose of comparison.

home with the aid of a broom for a crutch, and was confined there for four weeks. Now he suffers pain under his external malleolus and about his heel when he walks. Examination shows peculiar abduction of the heel, disappearance of hollow under the external malleolus, and thickening of calcaneum. Treatment, massage.

The X-ray (Fig. 2) shows an old line of fracture of the calcaneum through the body of the bone.

Case IV.—Whitfield Mabey, aged forty-four years, a conductor. Old fracture of both calcanea. The patient was thrown off a freight car six months ago, landing on both heels. He was carried to the hospital, and stayed there for thirty-eight days, suffering great pain. He says that both heels were swollen, and were black and blue. His injury was diagnosed sprained ankles. Since leaving the hospital the patient has been incapacitated for work. Examination shows both feet abducted; adduction painful; slight thickening is present about the heels.

The X-ray (Fig. 3) shows fracture of both calcanea, probably of the sustentaculum tali.

Operation was advised and refused. The treatment consisted of strapping and shoes. Later the strapping was removed and the heels were massaged and were soaked in hot and cold water. A Whitman brace was applied on one foot. At last notice the patient was at work, but was unable to pursue his former occupation.

Later: Patient announces that he cannot work, and has put in a claim for accident insurance on the ground of total disability.

Case V.—William Donald, aged thirty-seven years, a stone-setter. Old fracture of right tibia and fibula, and of left tibia and right calcaneum. Six weeks ago the patient's legs were squeezed in an elevator. The accident caused a compound fracture of both bones of the right leg, and a simple fracture of the left leg. The patient was confined to the hospital for four weeks and had his plaster of Paris removed this morning. Examination: Union, in good position, of the fractures of the leg bones. Thickening under external malleolus of the right foot, peculiar abduction of the ankle; motion of the ankle free. Normal hollow absent under external malleolus. Internal malleolus prominent. Patient now admits having fallen three

stories three years ago, landing on right foot. He was in the hospital fourteen weeks after the fall.

X-ray shows smashing of the calcaneum, probably true impaction.

Case VI.—Joseph Kennedy, aged forty-two years, a laborer. Old fracture of left calcaneum. Three weeks ago patient fell from a height of twenty feet, and landed on his feet. He was carried home, and has been confined to the house ever since. He says he was "black and blue" under the ankles. Examination: Patient limps; his gait appears painful. Slight thickening is present under the external malleolus of the left foot, with extreme sensitiveness to pressure. There is no marked deformity. Treatment, strapping and massage. Under this treatment the patient improved somewhat.

The X-ray shows evidences of old fracture, little more than a slight irregularity of structure of the calcaneum.

Case VII.—Frank Duberstine, aged twenty-four, a clerk. Old fracture of the left calcaneum. Two and one-half months ago patient fell one story and landed on his feet. He was carried home and was confined to his house for five weeks. During this time he suffered pain in his left ankle. He complains now of pain and stiffness. Examination shows abduction of the heel and disappearance of the hollows under the malleoli, and a thickening most marked under the external malleolus.

Later, a Whitman brace was applied and was of some benefit.

The X-ray (Fig. 4) shows a fracture of the anterior process of the calcaneum, perhaps also a slight amount of impaction.

Case VIII.—Lewis Barken, aged twenty-four years, an operator. Old fracture of the right astragalus. Three years ago the patient fell down an elevator shaft, landing on his feet. He was carried to the hospital, and was there for four months, with a diagnosis of "fracture." He says his right foot was "twisted inward." The treatment was with plaster of Paris. Since then the heel has been painful and stiff. Removal of the astragalus was advised; but the patient refused his consent.

The X-ray (Fig. 5) shows great crushing of the astragalus in the posterior part, and fracture of the tibia.

Case IX.—Christopher Cheyne, a derrickman. Old fracture of right astragalus. Ten weeks ago the patient fell one story. He was taken home in an ambulance, and was confined to the

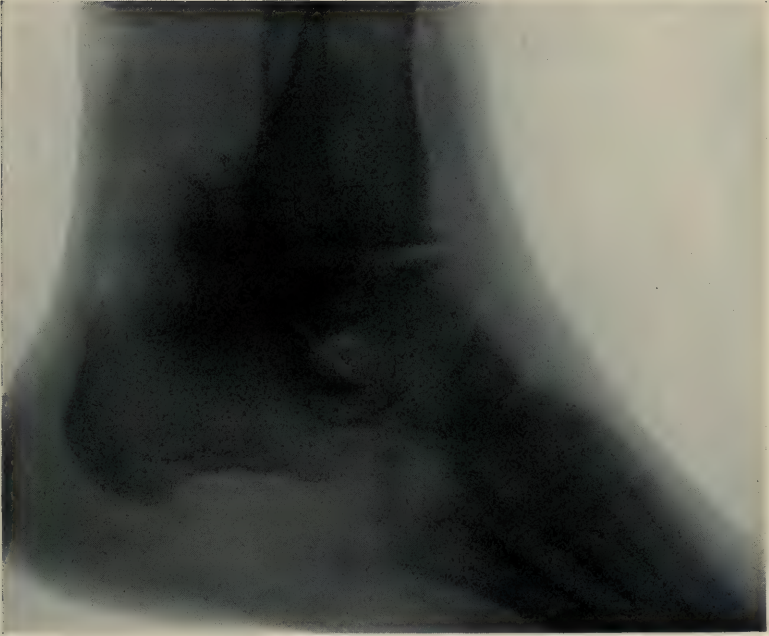


FIG. 5.—Old fracture of right astragalus. See Case VIII.

house for seven weeks with pain and swelling in his right heel. Since then he has suffered pain on walking. Examination shows thickening and stiffness about the ankle. Dorsal flexion is limited. There is no heel abduction nor obliteration of the normal concavities. Treatment, strapping.

The skiagram shows slight irregularity of the posterior part of the bone.

Case X.—William Curran, aged fifty-six years, a boatman. Old fracture of calcaneum. The patient fell in hold of boat five weeks ago, and landed on his left heel. He was in plaster of Paris for two weeks. "They claimed something was broke." Since then he has had pain and has limped. "Something was loose in heel." Examination shows thickening over the calcaneum. Treatment, strapping and shoes. On April 19, one month later, the patient had improved, but still suffered some pain. Hot and cold water was recommended. July 25, slow improvement; very little pain.

The skiagram shows a beautiful example of impaction of the calcaneum. The astragalus is also probable damaged in its posterior part.

Case XI.—William Fried, aged twenty-seven years, a machinist. Old fracture of left astragalus. Four months ago patient suffered a compound fracture of both bones of his left leg by being struck with a barrel. He was operated on in the Roosevelt Hospital. Examination shows a linear scar on the front of the shin, and another scar on the internal aspect of the leg, abduction of the foot, and thickening about the heel, and also limitation of abduction. The patient now says that he fell down stairs and that then the barrel fell down and struck him. The astragalus can be felt close up under the internal malleolus. Extension and flexion are limited at the ankle; they come to a sudden "bony" stop. Treatment, strapping and shoes. Two months later the foot was markedly improved; the patient was at work, and had good motion in his ankle.

The skiagram shows an old fracture of the body of the bone without much displacement.

Case XII.—George White, aged thirty-nine years, an ice-man. Old fracture of the left calcaneum. Patient says that he sprained his left ankle two months ago, and that since then he has suffered pain in it and has limped. The "sprain" was caused

by a fall from a height of ten feet. The patient landed on his feet when he fell. Examination shows thickening about the calcaneum, abduction of the heel, and disappearance of the hollows under the malleoli. Treatment, strapping.

The skiagram shows a slight change in contour of the calcaneum, probably a fracture of the sustentaculum tali.

Case XIII.—Edward Davey, aged forty-three years, a carpenter. Old fracture of right calcaneum. Three months ago patient fell a distance of fifteen feet and landed on his right foot. He was carried to the hospital and stayed there for over four weeks. His leg was encased in plaster for six weeks. The diagnosis seems to have been Pott's fracture. Since then the patient has suffered with pain and stiffness in his ankle. Examination shows the classical symptoms—thickening under the malleoli, obliteration of concavities, and abduction of the heels. Motion is not limited at the ankle. Treatment, strapping and shoes.

The X-ray shows fracture of the anterior process of the calcaneum, probably into several pieces.

Case XIV.—Patrick Lynch, aged thirty-six years, an electrician. Old fracture of the right calcaneum. Five months ago the patient fell about twenty feet, landing on his right heel. He was put up in plaster of Paris and went on crutches for five weeks. "They thought a bone was broken in the heel." Since then he has suffered from pain and has been disabled. Examination shows peculiar abduction of the right heel, filling out of hollows under malleoli, with thickening of the bone. Motion in the ankle joint is free. Treatment, strapping and shoes.

In the skiagram the sustentaculum tali appears to be fractured.

Case XV.—Robert Wheelhouse, aged forty-seven years, a machinist. Old fracture of right astragalus. Five months ago the patient fell from a scaffold at the height of five feet and landed on his right foot. He was carried to the hospital and was laid up for six weeks, with a diagnosis of "fracture of the ankle." Since then he has suffered pain in the ankle and has been disabled. Examination shows no peculiar abduction nor obliteration of the concavities. Bony thickening is present under the malleoli, in front of them, and behind them; and the malleoli are nearer the sole than normal. Motion in the ankle joint is



Fig. 6.—Old fracture of left calcaneum. See Case XVI. Normal bones of right tarsus shown for purpose of comparison.



Fig. 2. Old fracture of both astragali and calcanea, with impaction. See Case XVII.

practically nil. At last accounts the patient said he was improving with massage and hot and cold water.

The skiagram shows crushing of the body of the bone with displacement of the fragments.

Case XVI.—Lorenzo Cooper, aged fifty-six years, a watchman. Old fracture of left calcaneum. Eight months ago the patient fell twenty-two feet out of a window and landed on his left heel. He was carried in an ambulance to the hospital where he stayed for four weeks, and where he was treated with plaster of Paris. Apparently the diagnosis was fracture of the astragalus. He has been lame ever since, and has suffered pain in his ankle and in the sole of his foot. Examination shows marked thickening about the heel and disappearance of the normal concavities under the malleoli, the curved line being replaced by a straight one, so that the tops of the malleoli, cannot be distinguished. No peculiar abduction can be recognized, but both feet are flat. Plantar flexion is limited; dorsal flexion is not. Treatment, strapping.

The skiagram (Fig. 6) shows impaction of the anterior two-thirds of the calcaneum; probably crushing of the astragalus also.

Case XVII.—Miss W., aged thirty-nine years, a milliner. Old fracture of both calcanea; old fracture of left astragalus. Three months ago, in delirium, the patient sprang out of a second story window, thinking that she was pursued. She landed on both feet, and was carried to the hospital in an ambulance. There she stayed for eight weeks, suffering from pain and swelling in both ankles and heels. She says her complaint was diagnosed as sprain, and that she was treated with lotions. She began to walk in the fourth week, and has since complained of pain in both heels and in her right ankle. The right foot is the more painful, and the seat of the greatest pain in this foot is in the neighborhood of the external malleolus. The patient now wears broader shoes than before her injury, though of the same length, and is compelled to use crutches. Examination at the Hospital for the Ruptured and Crippled: Both heels are markedly thickened, the left more than the right. This thickening is perceptible to sight and to touch. The normal hollows under the malleoli and at the sides of the tendo Achillis are absent in both feet. The left foot is adducted; the right foot is slightly

abducted. The outlines of the malleoli cannot be made out. Motion in the left ankle is decidedly restricted. Treatment; operation advised, but not permitted.

The X-ray (Fig. 7) shows marked impaction of the anterior portion of the calcanea, and crushing of the left astragalus.

Symptoms of Tarsal Fracture.—The most important symptom of old fracture of the calcaneum or of the astragalus is a thickening of the heel, much more easily detected if the patient presents a sound heel on the other side for comparison. The thickening can be perceived better by palpation than by inspection. Rarely is it possible to tell from the location of this thickening which bone is fractured. The malleoli are nearer the ground than in the normal foot, and their outline cannot be distinctly made out. In fracture of the calcaneum the normal concavities under the malleoli are obliterated, and their place is taken by lines more or less straight. In fracture of the astragalus motion is, as a rule, limited at the ankle. In fracture of either bone the hollows at the sides of the tendo Achillis are usually filled out. Often a peculiar abduction of the heel is present in fracture of the calcaneum, quite different from the eversion of the ordinary flat foot. This form of flat foot, characteristic of the lesion, is readily explained on the hypothesis of fracture of the sustentaculum tali, for the astragalus, deprived of its support on that side, sinks inward. We should expect then, perhaps, that the internal malleolus would be depressed more than the external, as some writers maintain to be a fact. Probably they were dealing with this form of fracture. Others say that the external malleolus usually sinks the more; but they also find that the foot is flattened. Probably these were dealing with impacted fractures in which the external part of the bone suffered the greater damage. Ehret, in maintaining the greater descent of the exterior malleolus, explains the mechanism of this impaction of the outer portion of the bone, and attempts very cleverly to reconcile seemingly

conflicting views. In point of fact, neither malleolus "sinks" more than the other, except in relation to some part of the tarsus. *As long as the bones of the leg remain intact both malleoli must sink together.* This simple fact seems to have escaped notice.

In fracture of the astragalus the foot is regularly in adduction. The interesting question suggests itself, whether this adduction in fracture of the astragalus, and the abduction in fracture of the calcaneum are merely symptoms, or whether the position which the foot is in at the time of the injury stands in a causal relation to the resulting fracture.

The skiagrams of these fractures are much more easily interpreted if both feet be included in the picture. They are best taken from the lateral aspect. Although it is not always possible to tell by means of the X-ray the exact line of fracture, most of the author's cases of fracture of the calcaneum seem to belong in one of two classes: First, fracture of the sustentaculum tali; and, second, impaction of the body of the bone. In Case XIII the greater process seems to have been broken into several fragments. In fracture of the astragalus true impaction is not demonstrable, probably it never occurs. The bone is cracked between the calcaneum and the tibia, as is a nut in a nut-cracker. If the force continues, the bone is divided into pieces, sometimes many in number. These fragments may be displaced in various directions. The posterior portion of the bone generally sustains the greater damage. In Case VIII, with the foot in slight plantar flexion, the posterior portion seems to have been split off on the sustentaculum tali, and to have been dislocated backward. In Case XV the whole bone is, so to speak, flattened out by the impact of the tibia, again just as a nut would be crushed by a hard blow from a hammer. One of these patients with crushing of the astragalus fell from a great height, but the other only a few feet. Both patients, however, were quite stout.

Prognosis.—The prognosis of fracture of the tarsus, when treated in the usual way, namely, as a sprain or as a fracture of one of the leg bones, is distinctly bad. Most of the author's patients with fracture of the calcaneum were more or less disabled, and in not more than one case was the foot completely restored to function. It is not necessary to ascribe entirely the resulting disability to a loss of pronation and supination in the mid-tarsal joint (Ehret), though this may aggravate the symptoms. Nor do we need to accept the teachings of some of the French writers, that the trophic disturbances in the tissues beneath the heel are mostly to blame. In walking, the calcaneum bears the entire weight of the body, receiving a blow with each step; and in standing it bears a great part of the weight. The slightest change in the structure of the bone can readily cause great discomfort (Bähr). A small exostosis on its lower surface would have much the same effect as a loose stone in the heel of the boot. Again, almost invariably, except with tear fractures of the posterior part, some joint of the calcaneum is involved in the fracture, and is therefore distorted.

In fracture of the astragalus, the prognosis depends largely upon the amount of dislocation of the fragments. Cases VIII and XV of the author's series in which there was much displacement, have an absolutely stiff ankle, and are incapacitated for work. Case XI, with but little displacement, had a good result, and the patient pursues his occupation of chauffeur with little difficulty. Case IX, also without much displacement, when last seen was doing fairly well. Case XVII had a small amount of motion in her ankle, but complained of more discomfort in the foot in which the astragalus was not fractured. In none of the author's cases was the fracture compound. In compound fracture the prognosis might be different.

Treatment.—It appears from the foregoing that the treatment of these old fractures is unsatisfactory. Hot and cold baths, massage, strapping, and occasionally a

Whitman brace, may be tried, sometimes with fair results. In fracture of the astragalus with dislocation of the fragments, removal of the bone offers the only relief (Destot, Vegas, and others). In fracture of the calcaneum, with an exostosis in the sole, the protruding piece of bone can be chiselled off (Bähr).

The best results in the treatment of crush fractures are to be obtained at the time of their occurrence. With an impacted fracture of the calcaneum the impaction should be broken up if possible, and the foot should be put up in adduction and dorsal flexion. Bouchet's recommendation of lateral pressure to break up the impaction is worth trying. In fracture of the sustentaculum tali, the indication is clear; strong adduction and dorsal flexion will cause the astragalus to pull this process back into its place. The foot should be fixed in that position.

In fracture of the astragalus without displacement of the fragments, the main indication is strong dorsal flexion. When the fragments are displaced, their dislocation should be reduced, if necessary by an open operation. In this connection compare Cases VIII and XV of the author's series, in which the fragments were not replaced, with Urban's similar case, in which the ankle was opened and the dislocated portion of the bone reduced. In the first two cases the patients have a stiff ankle, in the last, Urban reports a complete recovery with a good joint. If the fragments cannot be replaced, they should be removed.

A good general rule in all tarsal fractures where the facilities for making an exact diagnosis are lacking, is to put the foot up in extreme dorsal flexion, and in inversion.

The best form of splint, after the primary swelling has subsided, is one of plaster of Paris, reaching from the bend of the knee to the toes. Under no circumstances should the patient bear any weight on his foot before the expiration of two months.

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COLOSSAL DERMOID CYST OF OVARY OF OVER FIFTY YEARS' GROWTH.

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THE accompanying illustration is contributed as an exhibit of a dermoid cyst of the ovary of unusual size and duration of growth, since cysts of that class seldom exceed in size a man's head.

The subject was a maiden lady, 60 years of age, in whom an enlargement within the abdomen was first noticed when she was ten years of age. It was then attributed to a fall sustained a short time previous. It slowly increased in size and made the greater part of her life one of invalidism. She finally, in September, 1906, entered the Danbury Hospital, that the tumor might be removed. This was done happily, September 17, and was followed by an uncomplicated recovery. The weight of the cyst and its contents was 32 pounds. The photograph (Figure 1) was taken immediately before the operation.



FIG. 1.—Dermoid cyst of ovary of fifty years' standing. Weight 32 pounds. Prompt recovery. Removed at Danbury Hospital September, 1905.

EXTIRPATION OF A HYPERNEPHROMA, WEIGHING FOUR AND A QUARTER POUNDS, FROM AN INFANT TWENTY MONTHS OF AGE.

RECOVERY.

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THE patient, a boy aged one year and eight months, was referred to me by Dr. M. P. Conway, Aug. 26, 1906. Family and personal history unimportant. Four months ago mother observed veins of right testis were swollen. Gradual enlargement of the abdomen followed. Appetite fair, and bowels acted normally. No urinary disturbance. Though irritable and fretful, child seemed not to have pain. Chief complaint, swelling of the abdomen.

Examination showed an infant thin but not emaciated, and pale but not cachectic. Abdomen enormously distended by a soft, solid growth, smoothly rounded everywhere except in the right flank, where a knotty mass was perceptible. Flatness everywhere on percussion, and a thrill on tapping the surface. No tenderness. Urinalysis shows no albumin or sugar, and no pus, blood, or other morbid deposit.

Operation, Aug. 29.—Ether. Patient in Trendelenburg position, as recommended by Abbe, to lessen bleeding and to keep the blood in the head after release of the abdominal vessels from pressure by the growth, thus diminishing shock.

In view of the great size of the tumor I selected the transperitoneal method, splitting the right rectus muscle from the costal arch nearly to the pelvis. The lumbar incision seemed to me not to offer so good access to a mass filling the belly, while the injury to the abdominal musculature would necessarily be greater, as the muscle fibres must be in part divided.

Statistics of the two operations give (Kuester) a mortality of 26.62 per cent. for the transperitoneal, and 24.70 per cent. for the loin incision. Even if this statement is accurate—and Jonnesco in 17 operations had a lower mortality from the transperitoneal route—the figures mean simply that it was the larger

and more complicated growths that required access by laparotomy, the higher mortality depending on the inherent difficulty of the cases, not on the operative method employed.

The statement that cases operated by the loin give one-half more permanent recoveries than those operated by the anterior route, is doubtless to be similarly explained.

The rectus opening gave a good view of the mass (Fig. 1), which with huge veins coursing over its surface presented a formidable appearance. Perpendicularly on its anterior face lay the ascending colon, lifted along with the posterior layer of peritoneum, behind which the tumor had developed. The other intestines were crowded over to the left, out of sight. In the peritoneum, constituting the anterior covering of the mass, an opening was made with scissors to the right of the colon (in order not to jeopardize its nutrient vessels coming from the left). Through this opening, by finger dissection, the peritoneum with the ascending colon was stripped from the tumor. Bleeding was free during this step, and required pressure with hot gauze to control. Indeed, the greater part of the blood supply of the growth seemed to come from these peritoneal vessels enlarged to meet its needs. Working behind to the right, I found and freed the kidney, and then by pressure on the outside of the abdomen, the tumor, *plus* the kidney attached by its upper pole, were delivered through the incision, which, generous as it was, had to be widely stretched to permit the extrusion of the mass. As this emerged it revolved to the right, like a geographical globe, exposing the pedicle, consisting of renal vessels, etc. (Fig. 2). An infected gland was disentangled from their midst, and then a catgut ligature applied, and the mass cut away.

It would have been possible in this case, I think, by a plastic resection to have preserved the portion of kidney not implicated in the growth, as was done by Abbe in one of his cases. But the child's condition became so bad that choice was made of the most rapid means of ending the operation.

Inspection now showed that the mesocolon stretched over the left side of the tumor had in the process of enucleation been torn from its gut for a space of some four inches. Here, too, there was no time for other course than to rejoin it as rapidly as possible to the colon, and hope for anastomotic restoration of the blood supply,—a hope happily justified by the event.

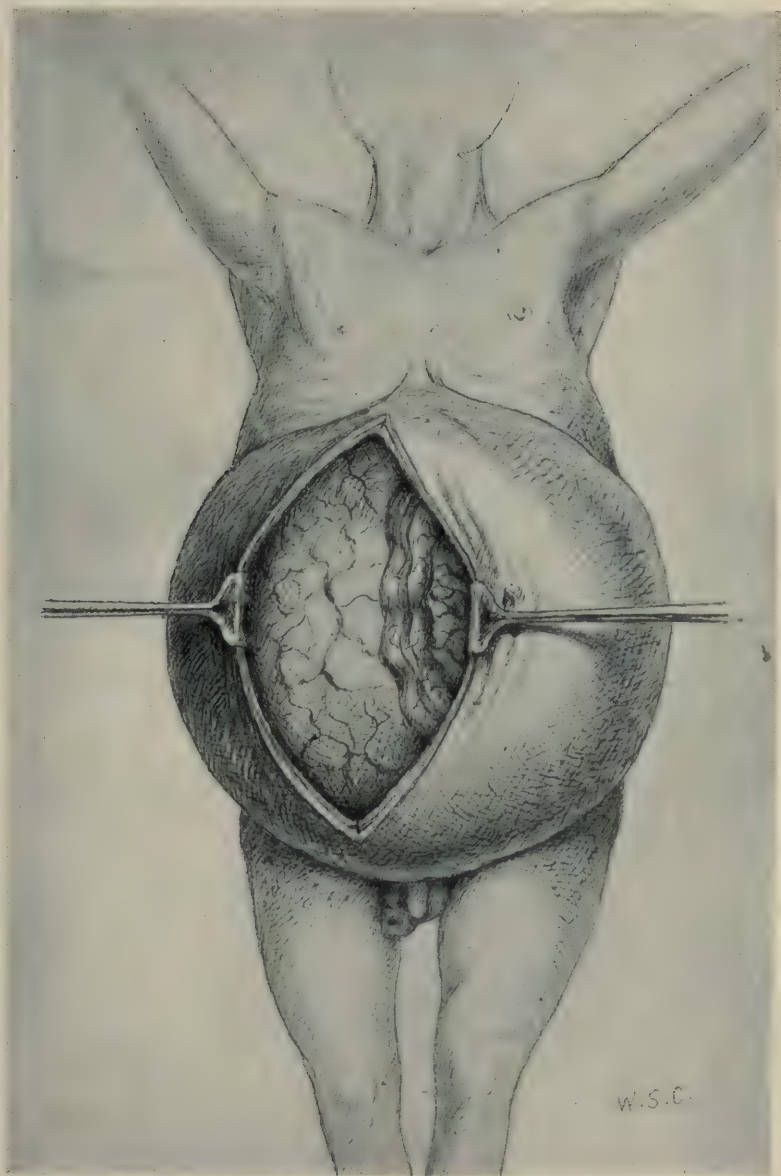


FIG. 1.—Appearance of tumor on opening abdomen. Note ascending colon and varicocele.

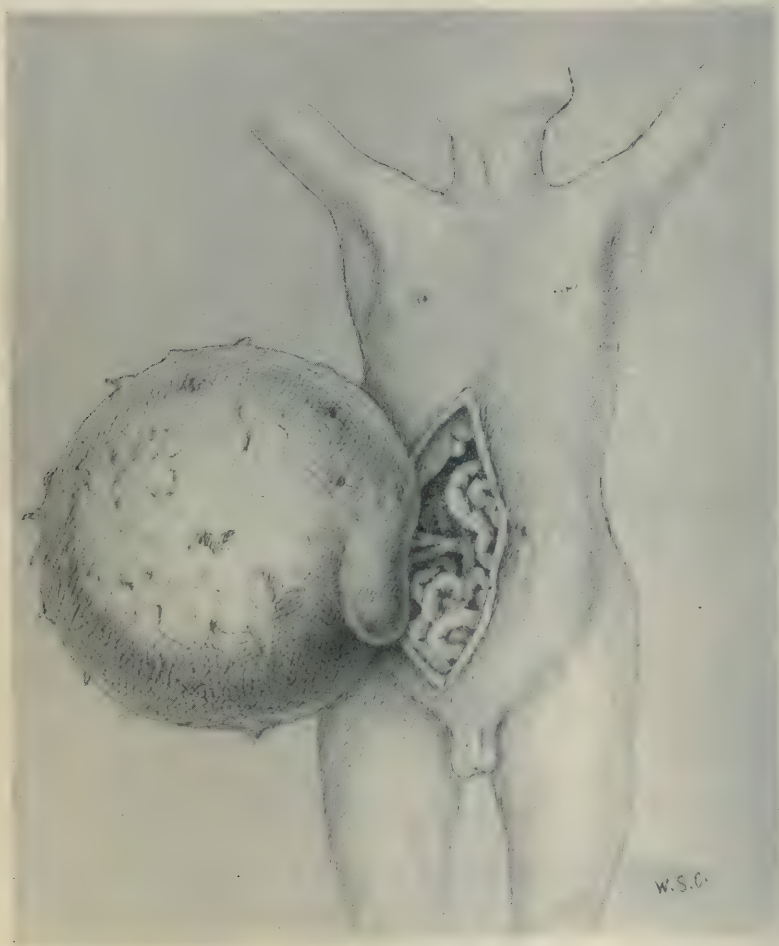


FIG. 2.—Schematic view of tumor delivered, still attached by pedicle. Note right kidney and tumor attached to its upper pole.

The opening made by scissors in the posterior peritoneum went for similar reason unsutured. The abdominal cavity was filled with hot saline, and the wound of entry quickly closed in tiers. Thus the child got off the table deeply shocked, but alive, which was almost more than had been hoped. Time of operation, 32 minutes.

Hypodermic stimulation, coffee and whiskey by rectum, patient placed at a slant, head down in bed. Temperature 102° in the evening, but fell to normal next morning, and remained there. Recovery was in all respects uneventful. The patient now taking on weight and looking rosy.

The tumor weighed four and a quarter pounds. Dr. Sondern to whom a specimen was sent for sectioning reported it to be hypernephroma.

One of the latest reviews of the prognostics of operation for malignancy of the kidney is contained in the "Handbuch der Urologie," 1905, edited by Frisch and Zuckerkandl. The writer (Paul Wagner) finds the operation-mortality much reduced in recent years,—from 61.22 per cent. (Gross) to 24.44 per cent. (Kuester). Schmieder's statistics gives 64.3 per cent. operation-mortality in the first decennium of renal surgery, 43 per cent. in the second, and 22 per cent. in the third. But the mortality among children is still 28.1 per cent.

As regards permanence of cure the literature furnishes but 34 cases living beyond the two-year limit *recidiv-frei*; and 21 cases beyond three years,—16 adults, 5 children.

So that while the case reported may be regarded as a fortunate instance of operative recovery, permanency of recovery can be affirmed only after some years.

INTRAPERITONEAL RUPTURE OF THE URINARY BLADDER.

WITH REPORT OF A CASE OPERATED TWO HUNDRED AND FIFTY-FOUR
HOURS AFTER ACCIDENT; WITH RECOVERY.

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On Sept. 28, 1904, a man was brought to Cook County Hospital, Chicago, with intraperitoneal rupture of the urinary bladder. Eleven days previous to admission he had received an abdominal injury, since which he had suffered from anuria and a progressive abdominal distension. He was operated two hundred and fifty-four hours after the accident, and was discharged from the hospital on the tenth day well.

The time element is the important and interesting feature in this case. It is unique in medical literature. Two hundred and fifty-four hours after the abdominal injury laparotomy was performed, the bladder sutured, and the patient made an uneventful recovery. Blumer (*British Med. Journal*, 1903, 1, 789) reported a case operated the sixth day after injury, with recovery. I believe Blumer's case has the longest intervening time from injury to operation of successful cases reported to date.

CASE REPORT.—F. G., a laborer, 45 years of age, was brought to the receiving ward of Cook County Hospital in the police ambulance, Sept. 28, 1904, at 6.17 P. M. He stated that ten days previous to admission he had been carousing and drinking during almost the entire night. About 4 A. M. he became involved in a brawl and was kicked several times in the right side just above the crest of the ilium and about the trochanter major. He had considerable pain in the abdomen and at the seat of injury at the time, and had to be taken home. In a few hours he felt better and tried to work for the following two days. But

the pain in the abdomen became so severe that he had to quit work on the second day. About the time he quit work he noticed that the abdomen was somewhat distended and since that time the swelling had gradually, but slowly, increased in size. Ever since he was injured he has been unable to void much urine, but has had very frequent desire to urinate, only a few drops being voided at a time. Since the injury what urine he has passed has been distinctly bloody. For the past eight days the abdominal pain has been very severe, and he has vomited several times a day. He thinks he has had no fever since the injury. There is a distinct alcoholic history extending over many years.

He was a fairly well developed, middle-sized man, past middle age of life. He lay on his side with legs drawn up. He complained of great distress in his abdomen and vomited during examination. Skin dry and cool. Pulse considerably accelerated, regular but very weak. Respiration somewhat rapid. Abdomen markedly distended, tense, with shining walls. Umbilicus protruding, subcutaneous veins prominent. On palpation there was some tenderness over entire belly. Percussion showed dulness over entire abdomen. A distinct impact was given on tapping the abdominal wall anywhere. There was no evidence of contusion of abdominal wall. Remaining examination had no points of interest.

The catheter was then passed and 5,800 cc. of blood-tinged urine was withdrawn. Abdominal distension disappeared and tympany obtainable, but still signs of fluid in abdomen. The record at this time shows temperature, 98; pulse, 108; respiration, 24. Patient was sent to operating room. The following notes are taken from history sheet:

“Operation.—Operator, Dr. George F. Thompson. Incision in median line four inches long, beginning one inch above symphysis pubis. Abdominal cavity opened. About 2,000 cc. bloody urine found free in peritoneal cavity. On superior surface of the bladder in median line was an opening with ragged edges, which admitted the thumb rather tightly. Opening in bladder sutured by Czerny-Lembert method, using medium-sized silk sutures. Abdominal cavity flushed with normal salt solution. Serosa smooth and shining. Peritoneum and abdominal wall closed by separate layer method.”

Bladder was drained for five days by means of catheter through urethra. The patient made an uneventful recovery, temperature never being above 100.6°.

It is noteworthy in this case that the patient performed his work as a laborer an entire day after the accident, and was not compelled to take to bed until the second day was well advanced. The symptom of shock was entirely absent, it being most probably that the patient had to be taken home after the injury more on account of intoxication than on account of the injury itself.

Yet, it is well known that serious injury to persons under the influence of alcohol often lacks just this element of shock, which is so important in the diagnosis of internal injuries. So, too, is rupture of the urinary bladder a relatively common occurrence in intoxicated persons, owing to the distension of the organ and to the dangers of trauma in this condition. On this point I quote Dr. Ashhurst (*Am. Jour. Med. Sc.*, July, 1906).

Another predisposing cause of importance is the condition of intoxications. Over 72 per cent. of the patients in whose records this point is mentioned, are reported as being more or less drunk at the time of the injury, and it is a sad fact that in not a few instances in which the patients themselves were sober, they sustained their injuries because of intoxication in some one else (Rose, Zoldewitch). Not only does drunkenness predispose to injury in this way, by making the individuals both quarrelsome and unsteady on their feet, but it increases the amount of urine excreted, and by dulling the sensibilities renders the persons so affected often unconscious that their bladders are overdistended, and may even deprive them, when drunkenness is a long continued habit, of the power of completely evacuating their bladders. The result of this last state—atony of the bladder—is that, although the patient may have passed his urine within an hour or so of the accident, his bladder may still be quite sufficiently distended to predispose it to rupture when subjected to sudden injury. Another serious aspect of intoxication in these patients is that they frequently remain unconscious of the gravity of their injury, as in the case of my own patient, and sleep off their drunken state only to awake the next morning with a peritonitis fully developed, which could almost certainly have been prevented by prompt operation.

It is worthy of note that among the patients who were intoxicated at the time of the accident, the mortality was over 43 per cent; while among the sober it was less than 28 per cent.

I shall not follow further the questions of symptoms and diagnosis, because these points have recently been exhaustively treated in Dr. Ashhurst's paper.

Herrick²⁵ reported the cases occurring in Cook County Hospital, 1889 to 1893. Out of a total of 8,000 surgical cases there were five of rupture of the bladder; an incidence of .0625 of 1 per cent. St. Bartholomew's Hospital report, quoted by Herrick, mentions but two cases out of 16,711 surgical cases occurring in the years 1869 to 1875, an incidence of .0125 of 1 per cent. At the Episcopal Hospital, Philadelphia, from January 1, 1900, to January 1, 1905, there were 8,367 surgical patients with three intraperitoneal ruptures of the urinary bladder, or .037 of 1 per cent. (Ashhurst).

The question of cirrhosis of the liver with ascites was brought prominently to the fore in discussing the differential diagnosis of this case. With the marked alcoholic history, the enormous distension of the belly with fluid, prominent veins—these spoke volumes for portal obstruction. The history of injury eleven days previous made one hesitate to pronounce rupture of the bladder on account of the good general condition of the patient, for the common text-book leads one to expect a rapidly fatal issue. However, Ullman cites from the literature a case which died on the sixteenth day. A case is recorded by Ledderhose which survived the immediate results of the injury, and recovered after the opening on the seventeenth day, of an intraperitoneal abscess in communication with the bladder.

The sudden development of ascites following trauma, the strangury, blood from urethra, and the practical anuria for eleven days made the diagnosis of intraperitoneal rupture of the urinary bladder the most probable. The passage of the catheter was decisive.

The academic question of peritonitis following rupture of the bladder is an interesting one. If an aseptic urine does not produce peritonitis in eleven days, how many days are necessary? I believe the proposition that peritonitis is

not an inevitable sequence is easily tenable. Therefore, soundings and catheterizations must always be made with utmost caution in all suspected cases.

Samuel Alexander¹, in reporting forty-five cases, his own and from the literature, stated that the time elapsing between accident and operation varied from two to ninety hours. Until Blumer's²⁴ case on the sixth day with a successful issue, ninety hours was the longest time elapsing. In this reported series of forty-five, twenty-three died,—sixteen from peritonitis, two shock, two hæmorrhage, one pneumonia, and two died on table. In four cases peritonitis was due to imperfect suturing. In eighteen cases no drainage was used,—nine recovered, nine died. In twenty-one cases catheter introduced into bladder and retained several days,—eleven recovered, ten died. Two cases, bladder drained by suprapubic method, and both recovered. Jones² added nine cases to the Alexander series, and, in commenting on these, states⁴: Thirty-two reported prior to 1893 had a death rate of $63\frac{1}{2}$ per cent.; twenty-two reported since 1893 had a death rate of $27\frac{1}{2}$ per cent.,—thus showing an improvement of 36 per cent.

In Ashhurst's recent report of one hundred and ten cases sixty-three patients recovered and forty-seven died, a mortality of 42.72 per cent. To this series we may add Marnock's two with no mortality, M. L. Morel's four cases with one death, and the case herein reported, making a total of one hundred and seventeen. Of these sixty-nine recovered and forty-eight died, a mortality of 41.02 per cent. for all reported cases. If to Jones' twenty-two cases reported occurring since 1893 we add the seven recent cases, out of a total of twenty-nine seven died, a mortality of 24.1 per cent. Thus we note the gradually lessening rate of mortality under asepsis, and modern methods of diagnosis and treatment.

Willett⁹ reported a case in 1876, Heath⁹ in 1879, Bull⁹ in 1885, all three dying from imperfect suture. McGill⁹ reported a case in 1886 which died from operative shock.

MacCormac¹² in 1886 reported two cases, the first successful ones on record, in which there was celiotomy and suture. He ascribed his success to the fact that he sutured only the musculature and serosa, while previous operators had always included the mucosa. Before MacCormac's triumph in bladder suturing, practically all patients with intraperitoneal rupture were doomed to die. Ullman¹⁶ collected 143 cases prior to 1886, only two of which recovered.

While a complete analysis of the literature with reference to the mechanism in intraperitoneal rupture of the urinary bladder was not made, the most common is from blows on belly wall by some blunt instrument, the booted foot playing a prominent rôle.

Intraperitoneal rupture also occurs in fracture of the pelvis from crushing injuries, but is usually associated with extraperitoneal rupture as well. Sugetinow³ reports a case of intraperitoneal rupture due to heavy lifting. During the excessive physical effort the patient felt a sudden, tearing pain in the lower abdomen. The patient lay in bed five days in a serious condition, but from the obscurity of the symptoms, diagnosis was not made. On the fifth day he was again seized with severe pain. The fatal issue occurred on the eighth day. Autopsy showed purulent peritonitis from rupture of the bladder. Sugetinow believed the rupture involved only the mucous and muscular coats until the fifth day. Intraperitoneal rupture has been reported in cases of vesical cancer. This accident must be kept in mind in dealing with this condition as the life of the patient can be considereably prolonged by either permanent suprapubic or perineal drainage. Loumeau reports a case in which he shows that lithotrity in inexperienced hands may result in laceration of the bladder, and, on account of the non-repair of the accidental lesion, may be followed by leakage and fatal peritoneal infection. The same author mentions another case that is an example of mixed rupture, spontaneous in appearance but in reality produced by a trauma dating back thirty years, a hypo-

gastric traumatism received at that time resulted in contusion of the bladder with a prevesical hematoma followed by adhesions between the bladder and the abdominal wall. These adhesions under the influence of violent and repeated movements, finally broke away from the walls of the bladder at their point of implantation on the organ, from which resulted a tear in the bladder wall.

My own connection with this case was that of examining surgeon in the receiving ward.

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DRAINAGE OF THE PREVESICAL SPACE THROUGH THE PERINEUM IN SUPRAPUBIC CYSTOTOMY.*

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SUPRAPUBIC cystotomy admittedly affords the best access for intravesical operations; and when primary union of the incision is secured, leaves nothing to be desired.

Usually, primary union is not secured nor even attempted; and since drainage of the urine through a suprapubic tube—*i.e.*, against gravity—is a failure, leakage into the prevesical space commonly occurs in spite of the many ingenious devices intended to avert it, including the purse-string suture and siphon drainage. Stagnation of urine in this space invites infection, sepsis, pneumonia, and compels prolonged confinement to bed. Hence the mortality of the suprapubic is in elderly patients distinctly greater than that of perineal incisions for the same purpose, notably prostatectomy.

In spite of this greater mortality, suprapubic has largely superseded perineal prostatectomy in Europe, because the latter operation, by transforming the perineum into cicatricial tissue, entails so many distressing sequelæ—perineal and rectal fistulæ (in 8 per cent. of 2,000 cases), permanent incontinence of urine (3 per cent.), cicatricial contraction of the prostatic urethra, besides impotence, epididymitis and other minor ailments.

Stagnation of urine and tissue fluids in the loose prevesical tissues can be prevented in two ways: (1) By abolishing and (2) by effectively draining these tissues. Abolition of loose tissues is secured by making the operation in two stages, five days apart; when this is done under nitrous oxid anæsthesia the risks are minimized.

* Read before the Chicago Urological Society, October 25, 1906.

The obvious objections to this method are avoided by the other plan, which, so far as I can learn, has not yet been recorded nor practised. This consists in drainage of the prevesical space into the perineum—at the bottom instead of the top—with complete closure of the suprapubic wound. The procedure is this: When the operator is ready to close the wound, the membranous urethra is opened on a grooved staff, the gorget introduced and staff withdrawn; a small trocar and canula is passed from above along the anterior surface of the bladder and prostate into the groove of the gorget. The trocar being withdrawn, a few silkworm strands are threaded through the canula and along the gorget out through the perineal wound (a small perforated rubber drain may be attached and drawn through by the threads). A large, soft catheter with multiple perforations having been introduced into the bladder for perineal drainage, the suprapubic incision, bladder and abdominal wall are closed completely except where the threads protrude, the anterior bladder wall being anchored near the recti muscles. Urine which may leak through the bladder wound, and tissue fluids, find ready exit at the bottom of this space.

In nine of eleven cases in which I have made this operation the wound has been entirely healed within two weeks; in the remaining two—prostatectomies in which oozing blood was allowed to block the perineal drain—the wound was reopened for the insertion of a larger drain. Greater care in checking oozing with formalin gelatine, should prevent this mishap.

DRAINAGE OF PROSTATIC ABSCESES THROUGH THE ISCHIO-RECTAL FOSSA.

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A MAN, aged 23, was admitted to Bellevue Hospital suffering from an abscess of the prostate. The abscess was felt by rectal examination as a tumor the size of a small hen's egg, situated in the median line and extending over to the left side. The patient gave no history of venereal infection, but said that he had been recently undergoing urethral instrumentation.

Operation.—In opening the abscess the approach to the prostate was by a lateral route which, being along natural planes of separation of the tissues through the ischio-rectal fossa and along the anterior pubic fibres of the levator ani, afforded easy access to the site of incising the tumor.

The accompanying figures, drawings over photographs of the dissections, illustrate the surgical anatomy of this method of lateral approach to the prostate for opening an abscess, and the steps of the operation. Drainage was made through the patient's left ischio-rectal fossa, though the illustrations show the anatomy of the right side.

Fig. 1 shows the line of the skin incision (A) projected upon the fascia forming the floor of the ischio-rectal fossa, and its relations to the tuberosity of the ischium, the external sphincter, and the gluteus maximus. There is here some distortion from the normal relation to the anal opening, owing to the relaxation of the sphincters in the dead subject. The incision starts at the fore part of the prominence of the tuberosity of the ischium at its inner aspect, which point is about on a transverse line passing through the anterior margin of the closed anal opening, and is carried diagonally backward and inward across the floor of

the ischio-rectal fossa in the space between the fibres of the external sphincter and the gluteus maximus muscles. The front portion of this incision, lying just internal to the tuberosity of the ischium, is deepened until it extends about one-half to three-quarters of an inch above the level of the extremity of the tuberosity, after which the finger introduced into the wound and passed along the smooth obturator fascia (Fig. 2, *B*) covering the inner surface of the tuberosity, enters a distinct fascial compartment (Fig. 2).

Fig. 2 shows this fascial compartment which lies in the outer portion of the ischio-rectal fossa, opened up. Usually no vessels traverse its space. It is limited externally by the firm obturator fascia (*B*) which is the guide to its ready detection by the entering finger, as described above. The apex of the space passes a little forwards above a transversely elevated band of tissue (*C*) in its anterior wall. The contour of this elevated band conforms to the base of the triangular ligament and, lying along the latter, the transverse perineal vessels and nerves. The fascia at the apex of the compartment—*i.e.*, just above the transverse band and consequently above the base of the triangular ligament—is now carefully punctured in a forward direction (indicated by the arrow), after which the finger is pushed through the opening into a plane of cleavage above the triangular ligament along the anterior bundle of levator ani fibres (Fig. 3, *D*), which follows the pubic ramus.

Fig. 3 shows the plane of cleavage along the anterior levator ani fibres above the triangular ligament, which the finger enters and dilates through the incision at the apex of the fascial compartment. In the dissection from which this picture was made, the base of the triangular ligament (*E*—posterior layer) on the right side was cut transversely across at the fore part of the ridge of tissue (*C*), after having first severed from the ramus for a short distance in front of the fascial compartment the superficial fascia, and with it the origin of the transversus perinei muscle. The tissues of the urethral triangle in front of this dividing incision,



FIG. 1.—A line of skin incision projected upon the fascia forming the floor of the ischio-rectal fossa. It begins at the lateral margin of the contracted anal opening, and passes backward and inward between the external sphincter and the gluteus maximus muscles.



FIG. 2 shows the fascial compartment in the outer part of the ischio-rectal fossa, limited externally by the firm obturator fascia (B), which is the guide in entering the compartment. The compartment was here laid open, instead of by the incision A, Fig. 1, by an angular incision, one arm of which ran along the inner margin of the tuberosity of the ischium, and the other parallel to, and a little in front of, the lower border of the gluteus maximus muscle. C, transversely elevated band of tissue in anterior wall of fascial compartment, containing transverse perineal vessels and nerves and the base of the triangular ligament. The arrow indicates the direction of the puncture at the apex of the fascial compartment and its situation above the level of the transversely elevated band or base of the triangular ligament.



FIG. 3 shows the plane of cleavage along the anterior levator and fibres (D) above the triangular ligament, opened up. The base of the triangular ligament (E, posterior layer) on the right side has been cut transversely across, and the structures of the urethral triangle anterior to this dividing incision, together with a longitudinal slice of the adjoining ramus (F), have been reflected over to the left. C, transverse band, containing margin of triangular ligament and transverse perineal vessels and nerves, left in situ. I, stick passed through the slit at apex of fascial compartment above the level of the transverse band. G, G, internal pudic artery.



FIG. 4.—Shows the anatomical structures that would lie between a prostatic abscess, bulging toward the rectum and laterally, and the finger introduced through the fascial compartment of the ischio-rectal fossa (in the course of the stick I) into the plane of cleavage along the anterior levator ani fibres above the triangular ligament. D D, anterior levator ani fibres which have been split apart to show immediately above them the recto-vesical fascia (H.) This fascia has been cut transversely along the lateral margin of the prostate (K) together with the recto-urethralis muscle (L) and the fascia (M) lining the prerectal space. The prerectal space has been opened up by blunt tearing of the delicate connective tissue which normally maintains its obliteration, so that the rectum sags backward, and through the opening in the recto-urethralis muscle the situation of the base of the prostate (K) can be seen.

together with a longitudinal slice of the adjoining ramus (*F*), were then reflected over to the left, so as to expose the plane of cleavage above the triangular ligament to view. The bridge of tissue (*C*) left in situ, contained a small portion of the base of the triangular ligament, and the transverse perineal vessels and nerves. Above this bridge, through the slit at the apex of the fascial compartment, a stick (*I*) has been passed to show the course of the finger as it enters the dilatable area along the anterior fibres of the levator ani. The only possible danger to be guarded against when puncturing the apex of the fascial compartment, is that of injury to the internal pudic artery (*G*, *G*). This artery had to be severed in the dissection to permit the reflection of the tissues. It lies a little external to the site of making the puncture, being in juxtaposition to the puncture at a point just where it emerges from the fibrous compartment of the obturator fascia. Thence the artery passes forwards to enter the compartment of the triangular ligament, where it lies close to the ramus. It could only be injured by an outward cut, which should consequently be avoided.

Fig. 4 shows the relation of the prostate to the rectum and to the structures which would intervene between a bulging prostatic abscess and the finger which has been passed into and has dilated the plane of cleavage above the triangular ligament. The first of these intervening structures is the levator ani muscle (*D*, *D*) at its anterior aspect, the fibres of which have been split apart to show above them the next structure, which is the recto-vesical fascia (*H*) covering the side of the prostate (*K*, inferior aspect) and reflected down over the recto-urethralis muscle, to pass below between the external and internal sphincters of the anus. A transverse cut has been made in this fascia just below the edge of the prostate, to reach next the recto-urethralis muscle (*L*), which in turn has likewise been cut transversely across in the line of the incision in the fascia, being thus divided close to its origin from the side of the

prostate. Beneath the recto-urethralis muscle is the fascia (*M*) lining the prerectal space. In this dissection the prerectal space, normally no actual space at all, but, as it were, a collapsed fibrous sac located between the rectum behind and the bases of the bladder and prostate in front, and capable of easy dilatation by blunt force, has been opened up, so that the rectum sags backwards, and the locality within this space corresponding to the base of the prostate (*K*) is seen through the opening in the recto-urethralis muscle.

In the case now reported, after having dilated the plane of cleavage along the anterior levator ani fibres above the triangular ligament with the finger, the abscess could be felt in the bottom of the wound as a prominent rounded elastic tumor, and was readily incised by a narrow-bladed knife passed along the finger. The artery to the prostate enters near the postero-lateral corner of the organ and ought not to be injured by the incision. The branches of the middle hæmorrhoidal artery, when present, lie close to the rectal wall antero-laterally, and would be pushed backwards out of danger by the bulging of the abscess. After the pus was evacuated, the cavity was drained with a tube surrounded with gauze. The *bacteriological examination* of the pus showed the infection to have been due to the staphylococcus.

Course.—The drainage material was rapidly diminished in amount so as not to interfere with the contraction of the abscess cavity. The wound healed from the bottom. On the fourteenth day the wound sinus was one and a half inches in depth. On the fifteenth day the patient left the hospital voluntarily. The wound healed uneventfully, and the patient had a perfect recovery.

This operation is suggested for cases of prostatic abscess of the kind here described which have not ruptured into the urethra and present a tense elastic tumor bulging toward the rectum. It is not recommended for cases where the abscess has ruptured into the urethra, when the operation of perineal section with drainage of the bladder advised

by Alexander¹ would be undoubtedly indicated. Left to itself a prostatic abscess will open either into the urethra, into the rectum, or it will break laterally and then frequently burrow along the anterior levator ani fibres into the ischio-rectal fossa. Since the last mentioned route is a natural channel through which the pus of a prostatic abscess can discharge itself without liability of serious complication, it would seem not improper to employ this same route as the one of approach for the early evacuation of such an abscess. Alexander advises perineal section indiscriminately for all cases of prostatic abscess, with a view of avoiding sinus formation or recurrence that would follow improper drainage of the abscess cavity. The claim of the writer is that if one good result *can* be obtained by this method for the class of cases mentioned, in support of its employment for these cases, it can be said that the operation is certainly much simpler of performance than that of perineal section, the after-treatment does not require special surgical knowledge, the after-discomfort to the patient is less, the bladder is not exposed to any danger of infection, and there is no subsequent urinary fistula to be treated, all of which facts would certainly appear as advantages in offering this method for trial, over the more radical operation, even though the latter be capable of producing an undoubted good final result.

As compared with simple drainage of a prostatic abscess by the anterior perineal incision, going between the bowel and the urethral triangle, the possibility of doing which by a definite anatomical dissection has been shown in 1902 by Gosset and Proust², and in 1904 by the writer,³ drainage by this diagonal lateral incision and approach through the ischio-rectal fossa would seem to have the preference for the following reasons: The route is direct and easily accessible; no danger of injuring the rectum or urethra; the scar is smaller and laterally situated.

The simplicity of this operation should at least appeal, if only as a temporary measure of relief, to the general

practitioner who may be called upon to relieve one of these conditions under surroundings unfavorable for performing more than the simplest operative measure.

For the proper treatment to obtain healing of an abscess of the prostate opened by the lateral route, the writer would suggest the following requisites: (a) The free and dependent drainage of the abscess cavity through a wide opening in the abscess wall; (b) the early removal of the drainage from the deep portion of the wound, to permit collapse of the bottom of the sinus; and (c) particularly the avoidance of irritating disinfectants, such as bichloride of mercury, carbolic acid, and potassium permanganate, for the syringing of the sinus. Peroxide of hydrogen, which is the best antiseptic solution for cleansing an abscess cavity, or a solution of chinosol⁴ 1 in 500, or simple boiled water alone should be used, none of which agents destroy tissue. As the deep part of the wound contracts, in order to insure its closure the drainage tube should reach only to within about two inches of the bottom, and should be progressively shortened as deep obliteration of the track takes place. As the discharge lessens and the track begins to granulate healthily, the closure of any sinus seems to be favored by suspending syringing altogether.

Lateral incisions for approach to the prostate have been reported by Dittel⁵ in 1890, and by Delagénère⁶ in 1900.

Dittel's method was employed solely for the removal of a lateral lobe of the prostate. He made his incision from the tip of the coccyx toward the anal margin in the median line, then around the external sphincter, ending at the perineal raphe in front. Delagénère recommended his method especially for hypertrophy of the prostate, also for abscess and malignant disease. His incision, which he called the longitudinal or parasacral incision, began at the base of the scrotum, descended in the median line to within two centimetres of the anal opening, turned thence in a semicircle around the anus, then followed the median line again to

the tip of the coccyx, and finally passed along the lateral margin of this bone.

Both Dittel and Delagénère are indefinite as regards the surgical anatomy of their operations. They both insert a sound into the urethra to prevent its injury.

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SILVERIZED CATGUT.

A STUDY OF THE METHOD OF CRÉDÉ FOR STERILIZING CATGUT WITHOUT HEAT.

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As is well known, Professor Cr  d  , of Dresden, has advocated the use of colloidal silver and silver salts in the treatment of various forms of infection, and also as a means for preventing infection. Many of these preparations are very efficient as antiseptic agents and are practically harmless. This is especially true of collargolum, which can be used intravenously in doses of 5 to 10 c.c. (1.25 to 2.50 drachms) of a 1 per cent. solution.

By treating catgut with colloidal silver the catgut itself is not only made sterile, but it becomes impregnated with an efficient and innocuous antiseptic agent which exercises a local inhibiting influence upon the growth of any bacteria which may have been introduced in the wound from any cause.

My personal observation during a visit paid to the clinic of Professor Cr  d  , substantiated the claims made for the advantage of such catgut for ligatures and sutures. I found that Professor Cr  d   used catgut sutures almost exclusively; that there was no post-operative infection attributable to the inefficient sterilization of the catgut, and, that post-operative infections from any cause were very rare. Cr  d  's treatment of the catgut was to impregnate it with colloidal silver, and preserve it dry; then, several days before use, it was placed in alcohol.

In the spring of 1905, while engaged in laboratory work in connection with the service of Dr. L. S. Pilcher in the Methodist Episcopal Hospital in Brooklyn, I undertook, through his advice and by his direction, to test specimens of catgut prepared in a manner similar to that of Cr  d  . The

tests covered a period of several months, and the present paper records the results of these observations.

Collargolum is simply metallic silver prepared in such a manner that it is soluble in water, but not diffusible through animal membrane. It was first described by Lee, in 1889, but was first prepared in a form practicable for use by Professor Cr  d   several years later. It occurs as simple, hard, brittle, bluish-black, scale-like pieces, which are soluble in water to the extent of 1 to 20; the solution being dark olive-brown in color and remaining stable for months.

No silver particles can be distinguished in the solution when observed under the highest powers of the microscope. It is not diffusible, and, in contradistinction to other inorganic bodies, the addition of albumin to collargolum prevents or delays the precipitation of acids and salts. A sufficient amount of albumin is therefore added to the collargolum during its manufacture to prevent its precipitation under ordinary conditions. Collargolum is unaffected by boiling; but boiling is quite unnecessary, as the solution is itself antiseptic.

“Collargolum may be introduced into the system intravenously, subcutaneously, endermically, or by mouth or rectum. Introduced intravenously it circulates in the blood for about eight to ten hours, and is then deposited in the organs or eliminated. It appears to be excreted through the intestines and kidneys, and never produces argyria. The elimination of silver is greatest during the first days. It can be detected after a week, and only after a month disappears entirely.

“No matter by what method the silver is introduced into the body, it exerts a markedly antiseptic action, and directly combats septic infection, whether due to staphylococci, streptococci, or similar bacteria, alone or combined with the bacteria of decomposition, which intensify the action of the pyogenic bacteria.”—“Colloidal Metals in Medicine.” Brochure. J. L. Berger, Berlin, 1904.

Collargolum therefore fills a very important place in the combatting of septic disease, and its marked usefulness is

attested by a large and growing literature both German and foreign.

Our first test was directed to determine whether there would be any advantage in soaking the catgut in ether before immersing it in the collargolum solution. A strand of catgut was divided in half and each half was wound on a glass spool; one spool was placed in ether for five days, the other was kept dry. Both were then immersed in a 1 per cent. solution of collargolum. Two days later, a section was removed from each spool; but neither was thoroughly impregnated with the silver, as shown by the failure to darken in the centre on exposure to light. The corollary to this fact was revealed by later experiments: namely, that two days' immersion in the silver solution was insufficient to sterilize the catgut in all cases. Sections removed four days later were found to be thoroughly impregnated. A couple of strands removed at this time were left lying on the laboratory desk, exposed to the dust and air, until used for subsequent experiments some weeks later. On the twelfth day the spools were removed from the collargolum solution, washed in running water, and placed in a covered glass dish. This was clean but not sterilized. No precaution was taken in handling the spools to prevent contamination.

This test failed to reveal any advantage to be derived from the preliminary soaking in ether. The non-etherized catgut absorbed the silver solution quite as readily as the other; and in all subsequent tests the preliminary immersion in ether was omitted.

It was eleven days before any further tests were begun. On that day several short strands of catgut were removed from the non-etherized spool without any aseptic precautions. Two were placed in two bouillon tubes, and three in an agar tube. The spool was then placed in 95 per cent. alcohol. After twenty minutes, a piece was removed from the spool under aseptic precautions, washed in water, and divided into five parts; three of these were placed in three bouillon tubes; and the other two in an agar tube. At the same time one of

the pieces that had been left lying on the desk exposed to the dust and air, but likewise to the direct sunlight, was cut in two, and one-half placed in a bouillon tube and the other half in an agar tube. All were then placed in the incubator at 37°. Of the nine tubes thus prepared, eight showed no sign of growth at the end of a month. One bouillon tube containing a section which had been removed without any aseptic precautions, showed slight growth at the end of the second day.

The spool from which the preceding tests were made, was allowed to remain in the 95 per cent. alcohol for two weeks. It was then removed and left lying on the laboratory desk. On the next day six short strands were cut off without aseptic precautions and placed in an agar tube. On the following day one strand showed growth at the tip end. Growth continued slowly from this point during the succeeding two weeks that the culture was observed. The other five strands remained sterile.

After lying on the desk for three days, the spool was soaked in alcohol for an hour and dried in the air for fifteen minutes. Sections were then placed in a bouillon tube and in an agar tube under aseptic precautions. Both tubes thus prepared remained sterile at the end of ten days.

For the purpose of making comparative tests, a spool of sterilized catgut was obtained from the operating room, and under all aseptic precautions sections were cut off and placed in three bouillon tubes and in an agar tube. Two short pieces were then cut off the same spool, drawn through unsterilized hands, and placed in two bouillon tubes. Sections of non-sterilized catgut were likewise placed in three bouillon and in an agar tube. On this same morning, Dr. L. S. Pilcher cut off two pieces from a strand of plain sterilized catgut, and two from a strand of chromic catgut that he was using during an operation, and dropped these into four culture tubes, two of bouillon and two of agar. A piece of silverized catgut which had been lying on the desk for five weeks was likewise dropped into a bouillon tube and all fifteen tubes placed in the incubator.

On the following day all three tubes containing the non-sterilized catgut showed heavy growth; so also did the two tubes containing the sterilized catgut that had been handled. Two of the tubes containing supposedly sterile catgut showed moderately heavy growth, the other two slight growth. The two agar tubes containing the sterilized catgut and the one containing non-sterilized catgut also showed beginning growth. Both the bouillon and agar tubes containing the chromicized catgut failed to show evidence of growth, and this remained true a week later. The tube which contained the silverized strand failed to show growth on the following day; but on the fourth day there was slight growth. Evidently the amount of silver present was insufficient to prevent all growth after such prolonged exposure to contamination.

Convinced by these tests that the silver solution was not only capable of sterilizing catgut, but also that it was capable of exerting a very marked inhibitory effect on the growth of bacteria adhering to the surface as a result of subsequent infection, our next tests were directed to the determination of the length of time necessary to ensure complete sterilization.

Before describing these experiments, a couple of points should be noted in reference to the preceding tests. All the silverized strands tested proved to be sterile except three. Of these three, one had been exposed to dust and air for weeks; and the other two had been cut off the sterilized spool with unsterilized scissors. The single test made on the chromic catgut showed it to be sterile. The six tubes containing supposedly sterile catgut all showed growth on the succeeding day. The corollary to this fact was discovered in a severe case of infection following suture for ununited fracture, and investigation showed that the catgut used at the operation and for the tests was from the same lot. No detailed investigation was made of the nature of the infection in the catgut, but from stab gelatine cultures and microscopic examination we concluded that we had present the staphylococcus aureus and albus, and an undetermined variety of bacillus.

During the succeeding weeks numerous tests of chromic

and plain sterilized catgut were made. The results were practically the same as the preceding. The chromic catgut appeared to be sterile in all cases; the plain sterilized was frequently infected. The plain sterilized catgut has been prepared by boiling in alcohol after the method of Fowler.

On May 27, strands of heavy, medium, and fine catgut were wound on separate spools and placed in a 2 per cent. collargolum solution. They were removed at varying intervals and tested as follows:

(1) May 29. Sections were removed from each spool, washed in running water from the boiler, immersed in alcohol for five minutes, dried in the air, and dropped into tubes of bouillon. On the next day no growth was apparent. On the following day there was growth in the tube containing the medium catgut. On the second day thereafter there was heavy growth in this same tube. At the end of two weeks there was no growth observable in either of the other two tubes.

(2) Sections removed from the collargolum at the same time, and treated in the same manner as the preceding, except that they were left in the alcohol twenty hours. At the end of the second day, the tube containing the medium catgut showed slight growth. The other two tubes remained clear at the end of two weeks.

(3) May 30. Sections of catgut were removed from each spool, washed in hot tap water and placed in alcohol.

(4) May 31. Sections removed from the spools and treated as the preceding.

(5) June 2. Sections prepared as the preceding.

Owing to a delay in obtaining culture media, it was ten days before these sections were placed in bouillon tubes. But as cold alcohol is insufficient to sterilize catgut, this delay could not have materially modified the result. All the tubes thus prepared remained sterile at the end of two weeks.

(6) June 5. Sections were removed from the spool of medium catgut, washed in tap water, and left in the covered glass dish for a week. They were then handled by Dr. Pilcher, without his having sterilized his hands, and were then placed

in three bouillon tubes. On the second day there was slight cloudiness in one of the tubes; but it did not increase. The silver present had apparently checked the further growth. At the end of two weeks all three tubes were perfectly clear.

(7) June 5. A strand of sterilized catgut was obtained from the operating room and handled as the preceding. It was then divided into three pieces and these were placed in three bouillon tubes. On the third day thereafter, two tubes had become cloudy, and the third contained a flocculent precipitate. At the end of a week, growth had increased slightly in all. At the end of two weeks, two tubes were very cloudy; the third contained a heavy precipitate.

The results of these tests may be thus briefly summarized: Perfect sterilization was sometimes achieved after two days' immersion in the silver solution, and always after three days' immersion. Catgut thus prepared showed a very marked resistance to subsequent infection, and, likewise, a marked inhibitory influence upon the growth of bacteria introduced with it into the bouillon solutions. This inhibitory influence was much less marked in the agar tubes. To obtain it, a partial dissolving out of the silver appears necessary, and this is exactly what occurs both in the bouillon tubes and in the tissues.

Encouraged by the favorable outcome of these experiments, our next step was to employ silverized catgut at an operation.

Several spools of medium-sized catgut were placed in a 2 per cent. collargolum solution, and left for five days. They were then washed in sterile water, dried for a few minutes in the air, and then placed in 95 per cent. alcohol. A couple of days later, catgut from these spools was used as the ligature and suture material at an operation for removal of tubercular glands of the neck. Two agar and two bouillon tubes were prepared from short sections cut from ends remaining after tying the ligatures.

Recovery after the operation was prompt and uneventful. The wound showed no sign of irritation and healed by primary

intention. All four tubes containing the samples of catgut employed at the operation, remained sterile after the lapse of ten days.

During the next week, the silver catgut was only used in selected cases, mainly those involving superficial operations. Since then, in the service of Dr. Pilcher, it has entirely replaced the plain sterilized catgut, for all purposes for which the latter is commonly employed.

During the earlier portion of this period, the silver catgut was repeatedly tested, but always found sterile.

Numerous tests were made as to the most suitable strength of the collargolum solution, and as to whether the same solution could be used twice in succession. We found that after the first time, the silver became precipitated, so that it no longer impregnated the catgut quickly and evenly. It is therefore advisable to place the maximum amount of catgut in the minimum of solution, but it must be rolled upon the spools before being placed in the solution.

For a time it was noted that the catgut when removed from the spool was a trifle soft and hard to thread; whereas a few minutes later it would be hard and almost wiry. The cause of this was found to be an error in technic. The catgut as it comes out of the collargolum solution is quite as soft as after soaking in plain water. In order to dry it, it is necessary to expose it to the air until the silver is deposited as a metallic sheen. If placed in the alcohol too soon, this change does not occur, until it is once more exposed to the air as at operation.

It was my purpose to make a number of tests of the relative tensile strengths of plain sterilized, chromic, and silverized catgut; but my investigations were interrupted after only one test had been made. This test was as follows: Strands of chromic, silverized, and plain sterilized catgut of medium size were each divided into two pieces, marked A, and B. The ends of each piece were tied together separately, making six loops. The loops were then placed on spools, and the tensile strength noted. The result thus found is that of two strands,

or double that of one strand. In every case the knots were so placed that they did not receive the full force of the strain. The point at which A broke having been noted, the broken ends were tied, and the piece again tested. The point at which the strand broke having again been noted, the longer piece was again tied in a loop, placed in water for fifteen minutes, and again tested. The strands marked B were immersed in water for thirty minutes and then tested. The results may be summarized as follows:

CHROMIC.

Aa broke at (knot) 19 pounds
 Ab broke at.....22 pounds
 Ac broke at.....18 pounds
 B broke at.....14 pounds

SILVERIZED.

Aa broke at.....20 pounds
 Ab broke at.....20 pounds
 Ac broke at.....16 pounds
 B broke at.....13 pounds

PLAIN STERILIZED.

Aa broke at.....20 pounds
 Ab broke at.....18 pounds
 Ac broke at..... 9 pounds
 B broke at..... 9 pounds

In other words, the silverized catgut appeared to be slightly stronger than the plain sterilized catgut, and slightly weaker than the chromic catgut. After immersion in water for fifteen minutes, the chromic catgut lost about 14 per cent., the silver catgut 20 per cent., and the plain sterilized catgut about 50 per cent. of the tensile strength. After thirty minutes' immersion in water, the chromic catgut had lost 33 per cent., the silverized 35 per cent., and the plain catgut 50 per cent. of the original tensile strength.

Although this single test fails to prove anything, it nevertheless corroborates the clinical evidence which shows that the silverized catgut is but little if any inferior to the chromic catgut in tensile strength and resisting qualities, and is very markedly superior to plain sterilized catgut in both these qualities.

In the preparation of the catgut for use, the method employed is as follows: Four coils of catgut, each containing ten strands, are wound on four glass slabs, and placed in a jar

containing a 2 per cent. solution of collargolum. They remain in this about a week, the jars being shaken once or twice in the interval. The slabs are then removed, washed in sterile water until the excess of collargolum solution is removed, and placed in 95 per cent. alcohol for fifteen to thirty minutes. After this the separate strands are wound on separate spools, under aseptic precautions, and preserved in 95 per cent. alcohol until used. Four coils are employed as the unit, as they exactly fill the jar containing the collargolum solution; and as many jars are prepared at any one time as may be necessary.

[NOTE BY DR. PILCHER.—Since the demonstration by Dr. Blake of the reliable qualities of silver preparation in rendering catgut not only aseptic, but also to a certain degree antiseptic wherever buried in a tissue, it has been used in all cases in my operative work at the Seney Methodist Episcopal Hospital, amounting in number to more than 500 operations, and has continued to give me abundant satisfaction and to justify, clinically, all the expectations which the laboratory experiments of Dr. Blake had suggested.

During this period there has been a notable absence of infective accidents in an active general service which has included nearly every variety of operative interference. Silverized catgut has become established as a permanent factor in our operating-room methods.

The method of preparation is simple and reliable, and may be commended to a further trial by surgeons.

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NOTE ON GONORRHOEAL OSTEOMYELITIS.*

BY R. C. CUPLER, M.D.,

CHICAGO, ILL.

ROBERT G., 20 years of age, a healthy, athletic young man. His previous history is unimportant. March 4, 1905, he consulted with me concerning his recently acquired acute gonorrhoeal urethritis. March 12, his posterior urethra became infected. He complained of a desire to micturate every few minutes. The straining to pass a few drops was accompanied with intense pain. Between these attacks he had sharp, lancinating pains through the deep urethra, extending up the rectum. He had painful erections without erotic incitation. Hematuria more frequent and of greater volume than I had ever seen. The right testicle became swollen. Constipation, headache, marked mental depression, loss of weight and appreciable fever were present. April 5, his left shoulder became severely painful. During the following days he had slight remissions from pain, always worse at night. He described this nocturnal pain as that of worms moving in the bone. Temperature 99 to 102, pulse 90 to 100, both fluctuating during the progress of the affection. April 9, the joint was now slightly swollen and motion was not very painful. Dr. F. J. Ehrman saw the patient on this date. The diagnosis of acute gonorrhoeal arthritis was suggested. Paracentesis of the joint gave about 20 c.c. of fluid; cultures and smears from this showed gonococci; no other organism present.

This procedure gave the patient no relief from the agonizing pain. The following day I opened the joint. It contained a few c.c. of fluid, the head of the humerus had a cavity with necrotic bone. Smears from here showed a biscuit-shaped diplococci in the protoplasm of the leucocyte and negative to Gram's stain.

To recapitulate: The patient was in his fifth week of acute gonorrhoeal urethritis; his swollen, congested, eroded urethral

* Read at a meeting of the Douglas Park Branch of the Chicago Medical Society, September 3, 1906.

mucous membrane afforded an ideal opportunity for the entrance of bacteria into the circulation. He had pain, directed to the upper end of the humerus, mainly nocturnal, boring, not relieved after the puncture or local treatment of the joint. Associated with an elevation of temperature, operation showed the roughened bone end of osteomyelitis. Relief followed only after bone curettage. Examination of the fluid and smears from the bone cavity gave biscuit-shaped diplococci which did not take the iodine stain. Therefore, I can come to no other conclusion than that the patient had osteomyelitis with the accompanying perforation into the joint and a secondary omarthritis, and that this infection was of gonorrhœal nature. I have failed to find another case reported.

Many organisms are capable of causing ostitis. Among those that are infrequent in the causation are *B. influenza*, *B. coli communis* and one reported by Litman. This organism, the *B. halo septicum* of Wyas, had its primary focus in a foetid purulent bronchitis.

Lexter says, osteomyelitis is an embolic process. The emboli are usually clumps of bacteria alone. If large they enter the diaphyseal artery; if small they enter and plug the epiphyseal and metaphyseal arteries, causing a wedge shape infarct. The bone marrow contains microorganisms in most all acute infections. They may live there for years and produce no symptoms. Frankel found staphylococci in the bone marrow in 9 out of 13 cases of laryngeal diphtheria. Staphylococci is the most common secondary invader found in this disease. In scarlet fever streptococci were found in 9 out of 13 cases in the bone marrow. Da Costa reports the finding of gonococci in bone from resection of a joint for gonorrhœal arthritis.

Burkhardt says, acute osteomyelitis with accompanied suppurating arthritis is nearly always fatal. Three times more males than females have osteomyelitis. It is more common between 10 and 17 years. I believe the blood supply has its relation here. Sometimes pyogenic bacteria are carried from one end of the bone to the other without involvement of the intervening shaft.

This case demonstrates that gonorrhœal bone infection is of about the same in its toxic effect as gonorrhœal infection is elsewhere. The common staphylococci ostitis shows more pronounced constitutional and toxic symptoms. Bone infection should be considered in the diagnosis of painful gonorrhœal arthritis.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, October 10, 1906.

The President, DR. GEORGE WOOLSEY, in the Chair.

STAB-WOUND OF THE KIDNEY.

DR. ALEXANDER B. JOHNSON presented a man, 39 years old, who was admitted to hospital on September 4, 1906. The history he gave was that he had just had a misunderstanding with some Italian laborers, one of whom had stabbed him in the right side of the back with the stiletto-like blade of an ordinary jack-knife.

Upon inspection, a stab-wound was found on the right side posteriorly, between the eleventh and twelfth ribs. The external wound did not bleed at all, and the patient, while he felt somewhat weak, complained of little or no pain. Thirty minutes after admission he passed, *per urethram*, three ounces of pure bright blood, which led to the diagnosis of a stab-wound involving the pelvis of the right kidney. On the following morning the kidney was exposed through a transverse incision made just below the border of the twelfth rib, disclosing a retro-peritoneal hæmatoma of considerable size. Upon separating the kidney from its surrounding connections, a stab-wound of its posterior surface near the outer border was found. This was three-quarters of an inch in length, about the same size as the external wound. There were no indications that the pleural cavity was involved. The wound of the kidney, which bled freely, was closed by a single mattress suture of catgut, and a small drain was inserted. The hæmorrhage was checked immediately, and the urine cleared up with the exception of a few blood cells. When the kidney was exposed, a good-sized instrument could be passed entirely through the organ, and into the pelvis and ureter. The subsequent history of the case was uneventful, the man making a rapid and complete recovery.

SOME CONGENITAL ANOMALIES OF THE KIDNEY
AND URETER.

DR. ALEXANDER B. JOHNSON read a paper with the above title.

DR. GEORGE S. HUNTINGTON said that the subject presented by Dr. Johnson also carried a great deal of inherent interest from an anatomic point of view, and the speaker said that he had personally devoted much time to anomalies of the genito-urinary apparatus. He hardly felt able to enter into a discussion of the surgical aspects of the question, and would limit himself to a brief reference to the multiple blood supply of the kidney, especially its arterial branches, which depended on the migration of the kidney from the primary inception of the organ in the Wolffian body, which was exceedingly vascular, and upon the fact that in its course of development it could tap the mesonephron at any point. It was on this account that the superabundant and not infrequent anomalous blood supply of the kidney could be explained.

DR. GEORGE E. BREWER said that in an examination of 150 subjects he had met with six cases of double ureter; in one of these the double ureters were complete and one of them communicated with a kidney segment which was the seat of tuberculous infiltration, while the remaining kidney substance and the opposite kidney were entirely free from disease. Dr. Bransford Lewis of St. Louis recently reported a very obstinate case of gonorrhoeal infection of the kidney in which, upon cystoscopic examination, he found two ureteral orifices on one side. From one he obtained perfectly normal urine, while from the other the urine was purulent. The case proved to be one of gonorrhoeal pyelitis affecting one segment of the kidney only.

Dr. Brewer said that in his investigations of vascular anomalies of the kidney he was surprised at the high percentage of cases in which such anomalies existed, and he recalled one instance in which there were five distinct renal arteries. In about thirty per cent. of the cases there was a separate and distinct, although comparatively small artery, leading to the anterior surface of the kidney.

DR. GEORGE WOOLSEY said that the vascular anomalies that were not infrequently observed in the dissecting room were of interest alike to the anatomist and the surgeon. Both venous

and arterial anomalies were comparatively common. He referred to a case reported by Dr. Robert F. Weir a number of years ago, in which the life of the patient was endangered by a severe hæmorrhage from the accidental tearing of an anomalous renal vein. He also referred to a case similar to the one mentioned by Dr. Johnson, in which the patient had only a single kidney and died of uræmia after its removal.

Stated Meeting, October 24, 1906.

The President, DR. GEORGE WOOLSEY, in the Chair.

SUTURE OF THE ILIOFEMORAL VEIN FOR STAB-WOUND.

DR. CHARLES H. PECK presented a man, 21 years old, who was stabbed in the left groin with a large bread knife during a street altercation early in the morning of September 5, 1906. He was carried into a saloon, where the ambulance surgeon found him lying in a pool of blood and almost exsanguinated. Pad pressure was applied to the wound and he was hurried to the hospital. A saline infusion was given, during the course of which active venous bleeding recurred, which required continuous digital pressure over tight gauze packing in order to control it.

When the patient was taken to the operating room and anæsthetized, it was found that the stab-wound had severed Poupart's ligament over the line of the great vein. The wound was enlarged obliquely upward and outward, and vertically downward. The femoral vein was exposed below the wound, and a temporary ligature placed around it. The peritoneum of the iliac fossa was pushed upward until the external iliac vein was exposed above, and a similar ligature was passed around it. The deep circumflex iliac and deep epigastric veins were then ligated to control the hæmorrhage, which the temporary ligatures on the great vein had failed to check. Inspection showed that the wound in the vein was from one-half to two-thirds of an inch in length; it involved the anterior wall only, and was exactly in its longitudinal axis. It was directly beneath Poupart's ligament, chiefly in the terminal portion of the external iliac vein. The open mouths of the deep epigastric and

deep circumflex iliac could be seen through the wound. Digital pressure directly over the wound in the vein was maintained by the House Surgeon, Dr. Coerr, until the temporary ligatures on the main vein were in place, and the tributaries tied off.

The wound in the vein was then closed with a through-and-through continuous suture of No. 00 chromic gut, which checked the hæmorrhage completely. This was reinforced by another layer through sheath and overlying tissues, and the temporary ligatures were removed. Poupart's ligament and the deep muscles were sutured with chromic gut. The wound was then closed with catgut and silk, excepting at the lower angle, where a cigarette drain was placed. A long posterior splint was applied, and the limb elevated. The pulse was scarcely perceptible at one stage of the operation, and an infusion containing adrenalin was given on the table. Time of operation, fifty-six minutes. The patient rallied promptly from the shock, and there was no further hæmorrhage, and no venous congestion nor coldness or œdema of the limb at any time. The patient's temperature ranged below 100.4° , and his pulse between 80 and 90 for the first three days after the operation, and after that never rose above 99.8, excepting once, on the twelfth day, when it reached 100. The dressings were changed on the third day, when the wound appeared clean, and the drain was removed. At the next dressing, on the seventh day, rather extensive sup-puration in the subcutaneous fat was discovered. This delayed the healing of the wound, but did not involve the deeper structures nor interfere with the healing of the wound in the vein. It was undoubtedly due to contamination of the original stab-wound, which it had been impossible to cleanse properly on account of the free bleeding. The limb was kept immobilized on a long splint for about two weeks. The patient was allowed out of bed on the twenty-fourth day, and left the hospital thirty days after the injury. The wound was practically healed, with the exception of a small granulating area.

PARTIAL GASTRECTOMY FOR CARCINOMA.

DR. CHAS. H. PECK presented a man, 66 years old, who was referred to him by Dr. Walter A. Bastedo, and was operated on at Roosevelt Hospital on July 13, 1906. He gave a history of stomach trouble dating back more than five years, with gradu-

ally increasing loss of flesh and strength, and vomiting, especially for the past two or three years. A mass could be felt in the region of the pylorus, and stomach peristalsis was visible through the skin.

Under ether anæsthesia, a vertical incision, five inches long, was made three-quarters of an inch to the right of the median line. About one-third of the stomach was occupied by an indurated mass, the center of which was on the anterior wall, two or three inches to the left of the pylorus. The lumen of the stomach was much constricted at this point, scarcely admitting the little finger through the rigid walled orifice. The pylorus itself was not involved. The stomach to the left of the obstruction was dilated, and its muscular coat much hypertrophied. The mass was not adherent to the surrounding structures, but the glands at both curvatures were enlarged. The first portion of the duodenum was divided with the thermo-cautery between clamps, about one inch below the pylorus. The cut end of the distal portion was closed with a continuous suture of heavy catgut, through all its coats, before removing the clamp, and then inverted with a purse-string suture of heavy silk. The lesser omentum was ligated in segments, and divided near the liver; the gastric artery was ligated near the cardiac end of the stomach. The stomach was then turned to the left, and the greater omentum ligated in segments below the line of the glands, as far as the middle of the greater curvature. The gastro-epiploica sinistra was then ligated, and the stomach divided between two long clamps, the excised portion including all of the lesser and about one-half of the greater curvature. The cut end of the stomach was closed with a heavy catgut lock-stitch suture before removal of the clamp. This was buried by a continuous catgut Lembert suture, and a third tier, of heavy silk, was placed in the same manner. A posterior gastroenterostomy was then performed with a Murphy button, Weir-flange, protected by interrupted silk Lembert stitches. The anastomosis was made in the first three inches of the jejunum. The edges of the slit in the transverse mesocolon were attached to the stomach by a few catgut stitches. A cigarette drain was inserted to the stump of the duodenum, and the abdominal wall closed by layers with catgut, chromic gut, silk-worm gut and silk. Time of operation, one hour and a quarter. The patient rallied nicely

from shock. A low rectal saline irrigation was given every six hours. Small quantities of sterile water were given by the mouth after twelve hours, and peptonized milk on the third day. There was no vomiting after the operation, and scarcely any nausea. The temperature barely reached 100° after the second day, and the pulse-rate was slightly above the normal. The patient's convalescence was uneventful. The button was never recovered in the stools, but as an X-ray picture taken before he left the hospital was negative, and he has had no symptoms suggesting its retention, its passage was undoubtedly overlooked. He was allowed out of bed on the twelfth day, and left the hospital eight days later. He was then eating a variety of solid food without discomfort. He has had no nausea or vomiting since the operation, and no distress after eating. He has gained about 30 pounds in weight since the operation.

The pathological report of the specimen was carcinoma, probably developing on the base of an old ulcer.

DR. WILLY MEYER, in speaking of the methods of securing the cut end of the duodenum in cases where the carcinoma involves the greater part of the superior horizontal portion of the same, referred to the following procedure, which he had applied in three of his cases, with excellent results: After the division and closure of the duodenum by the usual method, he considered it very wise, as an additional precaution, to stitch the head of the pancreas over it by a few interrupted sutures. If an omental flap can be drawn on top, one is still more secured against leakage from the stump. Under such conditions the insertion of a cigarette drain is superfluous. He has always closed the abdomen in his cases without drainage.

Dr. Meyer did not find his method mentioned in the extended discussion which recently appeared in the *Centralblatt für Chirurgie* on this subject or elsewhere in literature and therefore thought it worth while to mention it here.

DR. FRED. KAMMERER said he had followed this method of re-enforcing the sutured end of the duodenum mentioned by Dr. Meyer in two cases, quite a number of years ago. Both cases had done well and leakage from the duodenum was prevented. No doubt this method had suggested itself to other surgeons also.

PERICARDITIS TREATED BY DRAINAGE.

DR. OTTO G. T. KILIANI presented a man of 22 who was admitted to the German Hospital in 1901 for an attack of acute articular rheumatism, complicated by endo- and pericarditis. There was a large pericardial effusion which at one time became so threatening that it required immediate incision of the pericardium. Drainage of the pericardial sac was continued for seven days, after which the oozing ceased. Immediately upon incision, the patient, who had been practically moribund, showed signs of improvement, and his further recovery was uneventful. He had remained well up to the present time, a period of about five years.

BALL-VALVE TUMOR OF THE STOMACH.

DR. CHARLES L. GIBSON presented a man of 62, who was operated on at St. Luke's Hospital three weeks ago for the relief of gastric symptoms of some years duration, and consisting chiefly of a progressive loss of flesh and strength. An examination of the stomach contents, as well as the objective signs, led to a probable diagnosis of carcinoma.

Upon opening the stomach, a tumor as large as a good-sized cherry was found. It was attached to a pedicle about an inch and a half long, which sprang from just inside the pylorus. This tumor had apparently intermittently plugged the pylorus, thus giving rise to pyloric obstruction. The patient made a rapid recovery, and had since remained absolutely free from symptoms. The pathologist reported that the mass was polypoid in character.

DR. JOSEPH A. BLAKE said that in a somewhat similar case upon which he operated about four years ago, the tumor proved to be an adenoma. It was pedunculated, and at times caused symptoms of obstruction by being swept into the pyloric orifice. The speaker thought that most of these polypoid growths of the stomach were adenomatous in character.

SARCOMA OF FEMUR TREATED BY MIXED TOXINS.

DR. W. B. COLEY showed the following cases of sarcoma of the femur treated with the mixed toxins of erysipelas and bacillus prodigiosus:

CASE I.—E. R. F., 16 years old. *Giant-celled Sarcoma of*

the Lower End of the Femur, of central origin and rapid growth. The patient was admitted to Dr. Gibney's service at the Hospital for Ruptured and Crippled, on April 2, 1906, with a history that three months before she had first noticed pain on the inside of the left knee on walking. One month later she began to have slight tenderness in this region and a hard swelling appeared. This rapidly increased in size and very soon lameness developed. At the time of admission to the hospital, April 2, 1906, the patient's general condition was good and she was able to walk without apparatus, but had a decided limp. Just above the internal condyle of the left femur there was considerable enlargement, apparently of bony origin. The tumor did not connect with the cavity of the joint, but over the central portion deep palpation elicited a sense of fluctuation. The skin over the swelling was normal. Measurements of the thigh showed 1 inch atrophy of the affected side and $1\frac{1}{4}$ in. increase in size over the swelling just above the left knee.

The diagnosis in this case was difficult, and was settled by an exploratory operation by Drs. Gibney and Coley, on April 6, 1906. A $2\frac{1}{2}$ in. incision over the swelling on the inside of the thigh showed a fluctuating tumor which, on aspiration, was found to contain bloody serum. An incision was made into the tumor, and a considerable quantity of blood and serum evacuated. The cavity itself was the size of a small egg and occupied the central portion of the femur. The tumor was exceedingly vascular and hæmorrhage was stopped by gauze packing. The blood count was practically normal.

The specimen was examined by Dr. Jeffries, pathologist of the hospital, who pronounced it giant-celled sarcoma. It was thought worth while to try the mixed toxins for a few weeks in the hope of saving the limb from amputation. The toxins were begun on April 9, and continued for about a month in doses sufficient to cause a moderate reaction.

At first there was decided improvement in the leg, as shown by a decrease of nearly 1 inch in size. Very soon thereafter, however, the toxins apparently lost their effect and the tumor began to rapidly increase in size. After consultation by Drs. Gibney, Bull and Coley, it was decided to amputate below the trochanter rather than at the hip joint. This was done on May 18, by Dr. Coley, 4 inches below the trochanter. The patient,

though suffering a good deal of shock, made a good recovery, the wound healing by primary union. The toxins were resumed as a prophylactic, on June 9, since which time she has had 32 injections into the other thigh and into the stump of the amputated leg.

Her weight on June 12, just after the beginning of the toxins, after amputation, was $77\frac{3}{4}$ pounds. She increased from $\frac{1}{4}$ to 2 pounds a week steadily and at the present time, October 24, weighs $91\frac{3}{4}$ lbs. The patient is in perfect health and there is no evidence of a return either in the stump or any other portion of the body.

CASE II.—S. D., female, 18 years old. *Mixed-celled Sarcoma of the Lower End of the Right Femur*, of central origin. No trauma. The patient was admitted to Dr. Gibney's service at the Hospital for Ruptured and Crippled on March 29, 1906, with the following history: One year ago she first noticed pain in the right knee, which was first treated for rheumatism. The pain continued until August, 1905, when a plaster of Paris splint was applied at St. Luke's Hospital, the condition being at that time regarded as of tuberculous origin. The treatment was continued for about seven months, the splint having been removed six weeks before she entered the Hospital for Ruptured and Crippled. The last two months she had been confined to bed and was very much emaciated and extremely weak. The right knee presented a fusiform swelling just above the joint. Measurements (just above the joint) showed a circumference of 15 ins. on the right side, $11\frac{1}{4}$ on the left. The knee itself was acutely tender and any motion painful. X-ray photograph showed the lower 6 inches of the femur nearly twice the normal thickness. The clinical condition seemed clearly tubercular osteitis and Dr. Gibney decided to excise the joint. A semi-lunar incision was made through the ligamentous patella. The joint when exposed was found in perfectly healthy condition, while the femur above the joint was much thickened and presented three softened, purplish areas. These softened areas were curetted and a large quantity of disorganized cheesy material removed. The lower end of the femur was almost entirely disorganized, shaft and condyles being connected only by three narrow bridges of bone. The material removed closely resembled that of tubercular tissue, but the microscopical report stated

it to be mixed-celled sarcoma. The blood count showed: Red cells, 3,360,000; hæmoglobin, 85 per cent.

After the diagnosis of sarcoma had been established, the patient was referred to Dr. Coley by Dr. Gibney for amputation. This was done 4 inches below the trochanter, on April 7, 1906. The patient suffered little shock and made an uninterrupted recovery, the wound healing by primary union. She was put upon the mixed toxins on April 26 and the injections were given every other day. The patient showed a very rapid increase in weight, rising from 69 pounds on June 12 to 92 pounds on October 24. In August both patients were sent to the country for two weeks during which time the toxins were remitted. Both patients will leave the hospital to-morrow and the toxins will be discontinued for a few weeks at least.

These cases, of course, are entirely too recent to be claimed as permanent results and they were shown by Dr. Coley for the purpose of illustrating his recent change of view as to the proper method of treating sarcoma of the femur. Up to two or three years ago he strongly believed in amputation at the hip joint for this condition. In six of eight hip-joint amputations which he performed for sarcoma without mortality, the patients showed no permanent recovery. Five had a recurrence within six months of the operation and the sixth case could not be traced.

Of 68 cases collected from the literature by Butlin, in which hip-joint or high amputation was done for sarcoma of the femur, only one patient is known to have remained well over three years.

Dr. Coley stated that he had been able to find seven cases of sarcoma of the femur in this country in which the patient has lived beyond three years. In three of these seven cases success was undoubtedly due to the mixed toxins of erysipelas and bacillus prodigiosus. In a fourth case, an osteosarcoma of the femur, in which hip-joint or high amputation was done by Dr. Bull at the New York Hospital, 16 years ago, a very severe streptococcic infection of the stump followed the amputation. The patient recovered, and was well when last heard from, sixteen years later. In this case there is reason to believe that the infection had much to do with preventing a recurrence. In one case the sarcoma was situated in the upper portion of the femur, causing spontaneous fracture. The disease was so far advanced that, in the opinion of Dr. Gerster of Mt. Sinai Hospital,

there was no hope from hip-joint amputation and the patient was sent to the Montefiore Home for Incurables. He received prolonged treatment with the mixed toxins with the result that the tumor entirely disappeared and the bone re-united. The patient was in perfect health more than four years after treatment. In this case the microscopical examination, made by Dr. Mandlebaum, pathologist of the Mt. Sinai Hospital, and confirmed by Prof. J. N. Prudden of Columbia University, showed the growth to be giant-celled sarcoma.

CASE III.—Dr. Coley then showed a case of extensive *round-celled sarcoma of the left femur*, in which he had strongly advised hip-joint amputation in February, 1902, but neither the patient nor his family would consent to the sacrifice of the limb. The patient was then put upon the X-ray treatment from February until December, and while there was unmistakeable decrease in the size of the tumor of the femur, extensive metastases developed in the pectoral and lumbar regions in December 1902. A highly vascular mass developed under the left pectoral muscle, the size of a hand, which was partially removed by operation. The tumor in the lumbar region extended from the anterior superior spine up to the ribs, apparently of about the size of a child's head. The patient was then put upon the mixed toxins of erysipelas and the treatment was continued with intervals of rest, for the greater part of the next year. In a few weeks the lumbar tumor softened and became necrotic. An opening was made posteriorly and large masses of tumor material were drained away. At the present time there is no evidence of any sarcoma either in the lumbar or pectoral region and subsequent curettings have shown no sarcomatous elements in the femur. There still remains a chronic thickening of the femur, which has not, however, increased in nearly four years. The patient's general health is good.

The results in these six patients, together with those previously referred to, have led Dr. Coley to believe that the most rational treatment of sarcoma of the femur at the present time, when situated in the usual locality, namely, the lower end, is a brief preliminary trial with the toxins. If no marked improvement is evident at the end of a month, amputation below the trochanter should then be done, leaving sufficient stump to enable the patient to comfortably wear a false leg; followed by

prolonged use of the toxins immediately after wound healing, in the hope of preventing a recurrence.

Dr. Coley finally showed a fourth patient, with inoperable *round-celled sarcoma of the spine*, well nearly five years after treatment with the toxins.

CASE IV.—D. G., male, 20 years old. Diagnosis confirmed by Dr. H. Brooks, pathologist of the Bellevue Hospital. The tumor was of enormous size, involving the lower dorsal and upper lumbar vertebræ. The patient had lost about fifty pounds in weight, and there was so much pressure upon the spinal cord that there was total paralysis of the lower extremities, bladder and rectum, and he was so weak that he was unable to turn over in bed. Seen in consultation with Dr. V. P. Gibney, of the Montefiore Home, in February, 1902. The mixed toxins of erysipelas and bacillus prodigiosus were begun and continued by the house staff under Dr. Coley's direction; daily injections were given up to the following May, and severe reactions, temperature of 103° to 104° , followed most of the injections. Patient began to show improvement, local as well as general, almost at once. By September he was able to get out on crutches. In November he was shown before the New York Surgical Society by Dr. John Rogers. At that time he had regained nearly his normal weight and got about very well with the aid of a cane. In February, 1903, one year after treatment, he was able to walk perfectly well without support of any kind, and his general health had become perfect. He was able to resume his former occupation.

Dr. Coley stated that he considered this to be the most remarkable result ever obtained from the use of the toxins. Fortunately, there can be no doubt as to the diagnosis, since the tumor was not only examined by well-known pathologists, but specimens of the tumor have been preserved. He has shown this patient before various medical societies the past two years. The patient remains in perfect health, nearly five years after treatment.

DR. JOHN ROGERS said that one of the patients shown by Dr. Coley, the young man with the tumor on the back, had been under his care for several months. The growth was a massive one, involving the region now occupied by the scar, and showed every clinical evidence of sarcoma. The disappearance of the growth under the use of the mixed toxins was certainly very

remarkable. The speaker asked Dr. Coley what percentage of recoveries in sarcoma he had met with by the use of the mixed toxins.

DR. COLEY said that he could not answer Dr. Roger's question accurately without referring to his records. Furthermore, it would depend somewhat on the type of sarcoma. Originally, he was inclined to believe that the best results from the use of the toxins were observed in sarcoma of the spindle-celled variety, and very poor in the round-celled type. In recent years, however, he had been obliged to change his opinion in that respect, as many cases of round-celled sarcoma had been successfully treated by the toxins. Speaking offhand, he could positively say that he had observed from ten to fifteen per cent. of permanent cures following the use of the toxins, and in that connection, the fact should not be lost sight of that he only recommended the treatment in hopeless cases that were inoperable, with this one exception, namely, in sarcoma of the extremities, where an amputation of the limb would otherwise be imperative. In such cases he believed it justifiable to try the toxins for three or four weeks before sacrificing the limb. Up to the present time Dr. Coley had collected 12 cases (four personal and eight cases of other men) in which the arm or leg had been saved and eight of these patients were alive and well more than three years afterwards.

DR. ALEXANDER B. JOHNSON said he had under his observation a woman, about 35 years old, who had suffered from recurrent sarcomatous growths in various regions of the body. According to her history, her first sarcoma appeared when she was about a year old, and since that time she had submitted to at least fifteen operations for the removal of these growths. Personally, Dr. Johnson said, he had operated on her four times, and he knew of several other surgeons who had operated on her three, four or five times. The regions involved have been the breast, the lumbar and gluteal regions, the groin, etc. At the present time she had a sarcomatous mass in the abdomen, which he had found it impossible to thoroughly remove in spite of a very far-reaching dissection. He asked Dr. Coley whether, in his opinion, the mixed toxins were indicated in such a case.

DR. COLEY replied that under ordinary circumstances the use of the toxins would not be indicated under such conditions.

Still, he recalled cases equally hopeless, apparently, which had recovered under their use. The treatment required a thorough trial in order to prove or disprove its efficacy. In some cases it effected a marvelous recovery, while in others it was useless. In those cases where improvement occurred, it was apparently due to the systemic effect of the toxins, and not to their local action. In a case of extensive cancerous involvement of the mesentery which was referred to him by Dr. Willy Meyer about twelve years ago, the patient had recovered entirely under the use of the toxins. He had since remained well, and had recently married. In the spinal case he had shown, the patient had received no treatment since 1902.

EPIDURAL HÆMORRHAGE.

DR. ALEXANDER B. JOHNSON presented a boy, 19 years old, a native of Austria, and a tailor by occupation.

His past history was that he had suffered from occasional frontal headaches, which sometimes incapacitated him for work for half a day at a time. It was alleged by his friends that his mouth had always been drawn to the right, and that the left cheek was flattened, even when at rest. There was no history of epilepsy nor of venereal disease. The boy's habits were good.

On the morning of September 27, 1906, at 10 o'clock, he was knocked to the ground from a low wagon. He was able, unassisted, he said, to reach his home, a few blocks away, and walked up two flights of stairs. He at once complained of headache, and laid down. An hour later he vomited some food and a little blood, at the same time losing consciousness, and remaining in that state until six P. M. He vomited every time he turned his head, but there was no further vomiting of blood. There was no bleeding from the mouth, throat or ears. At six P. M. he recovered consciousness, and remained conscious for four hours, during which interval he vomited several times. An ice-bag applied to the head gave no relief to the headache. Leeches applied behind both ears made him feel weaker, but relieved the headache slightly. At this time he said he could not hear from the right ear. At ten P. M. he again became unconscious and continued to vomit on moving his head.

The following morning he was stuporose, but could be aroused; he would obey directions and even respond to ques-

tions at times. He still complained of headache, which was general in character, but most severe above the right mastoid region. He said it hurt him to see with the right eye and that there was still loss of hearing on the right side. He complained of no pain, save that in the head. The vomiting persisted. His friends state that his mouth was drawn to the right, but no more so than before the accident; that he was able to frown on both sides, to close both eyes tightly, and to move all his extremities. He had occasional slight twitchings, general in character.

The patient was brought to the New York Hospital in a carriage at 10.30 A. M. on September 28. Upon admission, he was stuporous, and could be roused with difficulty sufficiently to do simple things, such as opening the eyes or protrude the tongue, or briefly reply to questions. His eyes were closed; his expression apathetic, when not disturbed, yet he was very irritable, resenting any examination by turning about. The head showed no evidence of any injury. There was tenderness to percussion in the posterior temporal and mastoid regions on the right side; no change in the percussion note. The mouth was drawn to the right side; the left side of the mouth and left cheek were flaccid; the tongue was slightly coated and deviated a trifle to the left. No bleeding from the mouth, nose or ears. The forehead, in frowning, wrinkled only on the right side. Both eyes could be tightly closed, the right more so than the left. The right pupil was somewhat dilated, and failed to react to light. The opposite pupil reacted normally. There was no subconjunctival ecchymosis. On account of the patient's condition, it was impossible to test his sight.

Heart normal; pulse, 64, regular, slight increase in tension. Lungs and abdominal organs negative. The patient at times moved the extremities, and the right hand was occasionally carried behind the right ear, especially after pressure over that region. During most of the time the extremities were limp, dropping when raised. There were no evidences of paralysis. No loss of pain sensation. Fibrillary twitchings over the entire body at times, most marked over the left pectoral muscles and the left cheek. All the reflexes were present; the supraorbital was much more marked on the right side.

At two P. M. on the day of admission, the patient was very stuporous and could not be roused in the slightest degree.

Temperature, 99°; pulse, 64; respirations, 18. An immediate operation was deemed advisable, and was performed by Dr. Johnson at 3.30 P. M.

Operation.—An inverted U-shaped incision was made over the posterior part of the right temporal region. The scalp showed some ecchymosis. Four quarter-inch holes were then drilled into the skull, one at each corner of the exposed square. The bone flap was then completed with Hartley's skull saw, and the osteotome and hammer. Immediately on turning back the flap, which was about two and a half inches square, a large, dark blood clot came to view, which was easily removed by the fingers and irrigation. It covered an area half as big as an adult palm, and extended for some distance beyond the boundaries of the bone flap. A sharp spicule of bone along the anterior edge of the flap was removed by the rongeur forceps. The brain was markedly compressed by the clot, and did not pulsate. There was some arterial bleeding from a point in the dura near the lower part of the exposed area (posterior branch of the middle meningeal) which was controlled by a suture of fine catgut, and there was considerable steady oozing from above and in front of the exposed area, the source of which could not be determined, and which continued after temporary packing with gauze. Before the completion of the operation, the depressed brain had expanded and begun to pulsate. As the oozing from above still continued, a plain gauze drain was packed in between the dura and the skull, and led out at the upper, anterior angle of the bone flap, a piece of bone being removed from that corner of the flap by rongeur forceps to make an opening for it. The osteoplastic flap and the muscles were then carefully replaced, and the edges of the scalp united by sutures of silk.

Shortly after the commencement of anæsthesia, the patient's pulse and respirations became very slow, the former falling to 40 per minute, and the respirations to ten. With the opening of the skull, however, the pulse became more frequent, and almost normal; then, for a brief period, the pulse became weak and irregular, but its quality soon improved without stimulation, and the patient left the table in good condition. At 8.30 P. M., on the day of the operation, the patient was conscious. He was able to answer questions intelligently, and said that his

headache was much relieved. The tongue did not deviate. On the following day he was much improved, and the sight of the right eye was apparently good. There was no paralysis, excepting of the face. There was no loss of sensation; reflexes marked. On the third day, when the dressings were changed, the patient said he could hear perfectly well on the right side. His further convalescence was uninterrupted, and he left the hospital, entirely well, on October 15.

BILATERAL ANKYLOSIS OF TEMPORO-MAXILLARY JOINT.

DR. JOHN A. HARTWELL presented a girl of 17, who had an attack of diphtheria when five years old, and at that time it was first noticed that upon attempts to examine her throat, she was unable to open her mouth widely. The parents state that when she was three years old she fell and struck her chin, receiving a cut lip. It was not known that she received any injury to the jaw itself or whether this had any bearing upon the subsequent ankylosis of the jaw.

When the patient came under Dr. Hartwell's observation, last April, there was almost complete immobilization of the lower jaw. When she was asked to open her jaws to the extreme limit, the distance between the upper and lower incisors measured three-eighths of an inch, and she was unable to protrude the lower jaw beyond the upper one. An X-ray picture which was taken failed to show the cause of the obstruction, which was supposed to be due to an ankylosis of the temporo-maxillary joint.

Upon making an incision, Dr. Hartwell said he came down upon a bony mass which was firmly adherent to the zygoma above, and to the outer surface of the ramus below. Its attachment to the ramus was very firm, while to the zygoma it was attached by a band of fibrous tissue. With the chisel and rongeur the attachments were freed, first on one side and then on the other, until the articulation became perfectly normal. The operation was done about two months ago, and the patient was now able to open her jaws to the full extent.

Dr. Hartwell said he could give no cause for the bilateral ankylosis in this case. It was apparently not congenital, and so far as he knew, was unique.

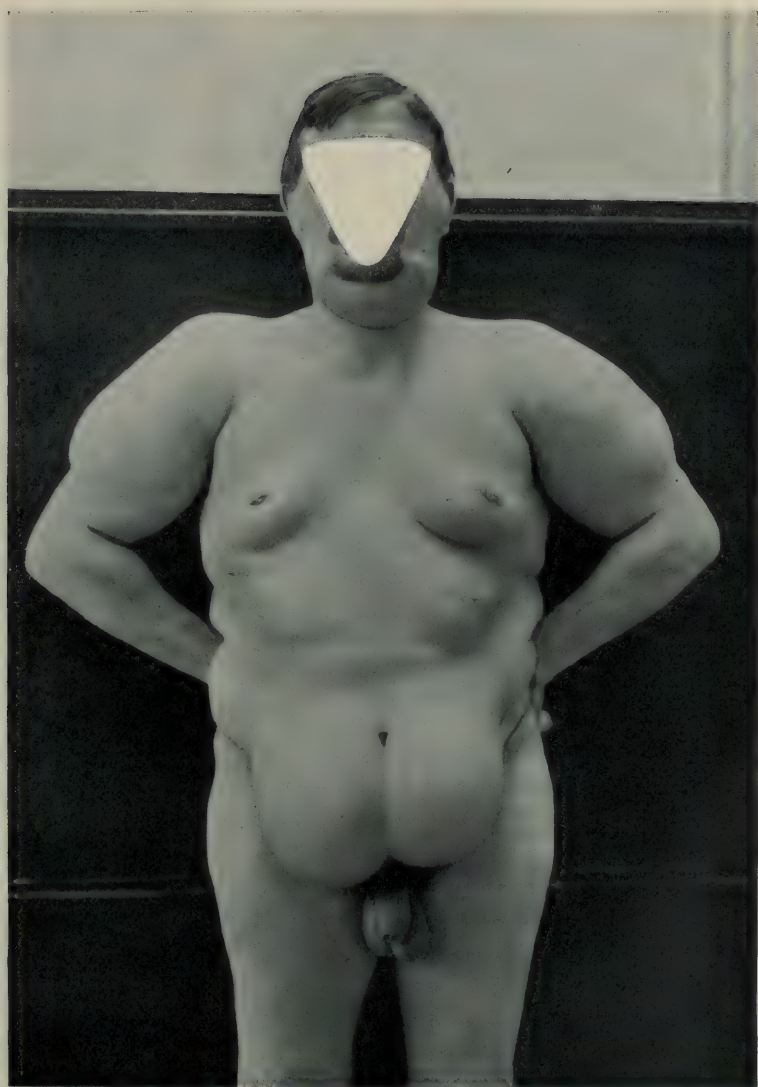


FIG. 1.—Multiple symmetrical lipoma.



FIG. 2.—Multiple symmetrical lipoma.



FIG. 3.—Multiple symmetrical lipoma.

TYPHOID, WITH DOUBLE PERFORATION OF THE ILEUM AND PERFORATION OF THE GALL-BLADDER; INTESTINAL SUTURES; CHOLECYSTECTOMY. DEATH TWENTY-ONE DAYS AFTER OPERATION; AUTOPSY.

DR. OTTO G. T. KILIANI read a paper with the above title, for which see page 34.

DR. WOOLSEY said that it was extremely doubtful whether the diagnosis of perforation of the gall-bladder could have been made under the conditions indicated without opening the abdomen. He could recall a number of cases of cholecystitis developing in the course of typhoid fever, but they were all of a comparatively mild character, and the symptoms gradually subsided. In such cases, a recurrence, with stone formation, was not infrequent. Dr. Kiliani's case was certainly both unique and interesting.

DR. KAMMERER mentioned a case in which septic temperature developed after typhoid fever had run its course. A swelling in the region of the gall-bladder finally indicated the seat of trouble and upon opening the abdomen an acutely distended gall-bladder was found. Incision of the same revealed several gall-stones and some seropurulent fluid, from which typhoid bacilli were easily cultivated. The gall-bladder was otherwise normal, and the case healed under drainage and the patient finally recovered after a very long illness.

MULTIPLE SYMMETRICAL LIPOMA.

DR. KILIANI showed a number of photographs of this case. (See Figs. 1, 2 and 3.) The patient was a man, 49 years old. His family history was good. He was markedly alcoholic; denied venereal disease. Four or five years ago he first noticed the appearance of these symmetrical lipomatous swellings, which gradually involved the face, shoulders, abdomen, thighs, etc. Dr. Kiliani said that at the request of the patient he had extirpated two of these swellings in front of the ears, on account of the disfiguration they had given rise to.

DR. KAMMERER referred to two cases of symmetrical lipoma, which he had observed almost ten years ago and in which a marked diminution in the size of the tumors followed the use of thyroid extract.

DR. WOOLSEY said he saw a case during the past year in which the lipomatous masses occupied the axillæ and both sides of the neck and were somewhat painful. The growths in this case were in a woman who was operated on for gall-bladder disease.

DR. KILIANI, in closing the discussion, said the type of cases of which he had shown photographs was entirely different from that in which the tumors apparently followed the course of certain nerves.

Stated Meeting, November 14, 1906.

The President, DR. GEORGE WOOLSEY in the Chair.

SUBCUTANEOUS RUPTURE OF POPLITEAL ARTERY AND VEIN.

DR. BENJAMIN T. TILTON presented a boy 17 years old, who on June 27, 1906, was seated on the rear end of a large truck, with his legs hanging over the end. The truck was on the car-track and started to leave it in order to allow a car that was following to pass by. The motorman of the car did not allow the driver sufficient time to get off the track, and collided with the rear end of the truck, the car striking the boy a blow on the flexed knee, and forcing the back of the knee against the tail-board of the truck. The boy complained of great pain in the popliteal space, and was unable to walk. He was brought to Bellevue Hospital by ambulance.

Upon admission, the physical examination showed a slight abrasion on the front and outer side of the knee below the patella. The knee was held in a slightly flexed position. There was a fulness in the popliteal space. There was no ecchymosis, and the knee-joint contained no blood. There was no tenderness in front, but posteriorly there was marked tenderness in the popliteal space. Extension of the knee was impossible on account of the pain. There were evidences of loss of circulation in the foot and leg.

On the following day the swelling in the popliteal space had increased, extending further up and down the leg. There was a slight yellow discoloration in the calf. Absence of pulsation in the leg and foot persisted. On the following day an

operation was undertaken to relieve the pressure of the increasing hæmatoma which was causing the patient great pain, and to determine the condition of the popliteal vessels.

An Esmarch bandage was applied, and an incision made in the popliteal space. A fair amount of clotted blood was evacuated, and it was found upon inspection that both the artery and vein were completely severed, the two ends of each being separated fully an inch. There were thrombi in the proximal ends. As consent for amputation had not been obtained the artery and vein were ligated proximally and distally, and the wound partially sutured. It was noted that the amount of hæmatoma seemed small in relation to the size of the vessels which had been completely ruptured.

The pain in the leg continued, and signs of beginning gangrene of the moist variety showed themselves. The temperature rose gradually to 105° , and there was evidently no chance of saving any part of the leg, which had now become infected. On account of the threatening sepsis, a Gritti amputation was performed on July 10, thirteen days after the injury. There was not sufficient healthy skin tissue behind to permit of approximation with the anterior flap; consequently, the wound was left open, posteriorly, and packed. No infection occurred, in spite of the close proximity of the amputation to the gangrenous areas. The sawn surface of the patella united promptly with that of the femur.

The granulating surface behind was finally covered by skin grafts a few weeks after the amputation, and a good stump resulted. The case was interesting, Dr. Tilton said, First, on account of the rarity of this particular injury; Secondly, because of the question of the mechanism that produced it; Thirdly, because of the very slight accompanying injury of the skin and soft parts; and, Fourthly, the question of possible suture of the divided artery and vein.

DR. L. W. HOTCHKISS said that he had had one case similar to the one presented by Dr. Tilton. The patient's leg was caught between the buffers of two cars. There was a comminuted fracture of the lower end of the femur, slightly compounded, which was treated in the usual way, as the full extent of the injury was not at first recognized. Rapidly developing gangrene of the foot led to an incision over the popliteal space,

which revealed a complete rupture of the artery, the two ends of the vessel being widely separated. Amputation of the leg was followed by recovery. In this case he thought the question of arterio-venous anastomosis was out of the question.

DR. FRANK W. MURRAY said that some years ago, at the old Chambers' Street Hospital, he saw a sailor who had met with a similar accident while paying out rope on a tugboat. His leg was caught in a coil of the rope, and he received a very severe wrench in the region of the knee. When he was brought to the hospital there were no signs of a fracture; there was some laceration of the skin, and a slight hæmatoma in the popliteal region, with exquisite pain, and entire absence of pulsation in the anterior and posterior tibials. On the following day the condition being practically unchanged, the popliteal space was explored, and a complete rupture of the popliteal artery and vein was found, and though the ends of the severed artery were curled up, the condition of the ends of the severed vessels, together with the laceration of the surrounding tissues did not allow of any attempt at an end-to-end suture, so amputation at the knee was performed.

DR. HOWARD LILIENTHAL, in reply to a question as to whether a suture of the vessels would have been feasible in a case like the one reported by Dr. Tilton, said he had had no personal experience with injuries of that character. If suture of the vessels was resorted to in such a case, it would have to be done after the manner demonstrated by Carrel, which he would subsequently describe in his paper.

RESECTION OF THE ANKLE FOR TUBERCULOSIS.

DR. WALTON MARTIN presented a girl, ten years old, who was admitted to the Roosevelt Hospital January 19, 1906, in the service of Dr. Blake.

For the past two years she had been suffering from tuberculosis of the right ankle. The ankle was much swollen; she was unable to walk on account of the pain, and there was a discharging sinus near the inner malleolus. The X-ray showed a focus of diseased bone in the lower end of the tibia, near the epiphyseal cartilage.

Conservative treatment was carried out for three months. The sinus was curetted, the joint immobilized, and the child

was kept for the greater part of the day in the fresh air. During this period, Dr. Norman E. Ditman treated the child with injections of tuberculin. The tuberculo-opsonic index was .5 on February 17; on April 6 the index was 1.5. Notwithstanding, the joint, after a period of temporary improvement, became worse. The pain increased, and the swelling extended to the region of the external malleolus.

On May 4, 1906, the joint was resected. The ends of the tibia and fibula were sawn across, and the astragalus removed. The diseased capsule was dissected out, the old sinus curetted and drainage tubes were introduced in the lateral incisions. The temperature reached normal twenty-one days after the operation. The old sinus and the drainage openings closed gradually, and the child was discharged from the hospital cured early in July. She passed the following two months at Sea Breeze, Coney Island. At present she is in good health, has a movable ankle and can walk without pain or discomfort.

DR. HOTCHKISS said he saw the patient in the Hospital early last summer, and again after her return from Sea Breeze, and had been struck by the remarkable improvement in her condition.

DR. JOSEPH A. BLAKE, who had also seen the patient, said, that for a time her condition was regarded as very precarious. The improvement in her appearance, to which Dr. Hotchkiss had referred, was so marked that one would scarcely recognize her as the same person.

SMALL ROUND-CELLED SARCOMA OF THE NECK AND TONSIL;
ENTIRE DISAPPEARANCE IN SEVEN WEEKS UNDER
TREATMENT WITH THE MIXED TOXINS OF ERY-
SIPELAS AND BACILLUS PRODIGIOSUS.

DR. WILLIAM B. COLEY presented a man, 32 years of age, who had already been shown by him at the January, 1906, meeting of the Society. His family history was good. The patient had been referred to him on October 17, 1905, by Dr. Arpad G. Gerster as an inoperable case of recurrent, small round-celled sarcoma. The following history was obtained.

About the middle of August, 1905, the patient noticed a swelling on the left side of the neck, just behind the sternomastoid muscle. At about the same time he also noticed an

enlargement of his left tonsil; there was no pain at first, but as both tumors increased rapidly in size, they soon became painful. In the latter part of August, 1905, the patient was operated upon at St. Mark's Hospital by Dr. Carl Beck, who made an attempt to remove the tonsil tumor, as well as that of the neck. He found it impossible, however, to make a complete excision. The patient was immediately put upon the X-ray treatment every other day, and also received radium treatment externally and internally; the latter, however, had little if any influence in checking the rapid growth of the tumor. On October 13, while under the care of Dr. Goldwater, at the New York Polyclinic, a portion of the tonsil tumor was removed and examined by Dr. F. M. Jeffries, Director of the Pathological Laboratory of the New York Polyclinic, and also by the Pathologist of the Practitioners' Laboratory, both of whom reported the tumor to be a small round-celled sarcoma.

On October 17, when Dr. Coley first saw the patient, a physical examination showed the following condition: The left side of the neck was occupied by a globular tumor, about the size of half an orange; it extended from the angle of the jaw in front to the mastoid process behind, and downwards nearly to the clavicle. Its consistence was about the same as that ordinarily found in round-celled sarcoma; the skin was not adherent. Examination of the left tonsil showed that it was enlarged to two or three times its normal size. The patient's general health had been but little affected. He was admitted to the General Memorial Hospital on October 17, 1905, and immediately put upon the mixed toxins of erysipelas and prodigiosus, without any other treatment. Daily injections were given, alternating, one day into the tumor direct; the other, into the pectoral region. The highest dose given was seven minims; his temperature ranged between 99.5 and 103. In less than a week there was a decided decrease in the size of the tumor, and an increase in mobility. The diminution continued steadily, until, at the end of six weeks, both the cervical and tonsil tumor had apparently entirely disappeared. He left the hospital at the end of seven weeks, and although there were no visible remains of the tumor, the toxins had been kept up twice a week in the pectoral region as a prophylactic against further recurrence.

Dr. Coley said it was interesting to note in connection

with this case that the toxins, which were prepared by Dr. B. H. Buxton, of the Loomis Laboratory, were eight months old.

DR. HOWARD LILIENTHAL asked Dr. Coley what proportion of cases of sarcoma treated by the mixed toxins were apparently cured. Also, whether he had noted that metastases might occur in spite of the use of the toxins. In this connection, Dr. Lilienthal said, he wished to report the probable final history of a patient whom he had shown on two occasions to the members of the Surgical Society. The patient was a young girl with a sarcoma of the scapula; this was removed, and she made an excellent recovery. There was, however, a slight local recurrence, which disappeared under the use of Coley's fluid. She then remained well for a period of almost two years. Recently she returned with a recurrence in the mastoid of the corresponding side. After that had been operated on by Dr. Charles A. Elsberg, and removed quite radically, there was a further recurrence in the lung, and the patient was now rapidly failing and in an apparently hopeless condition.

Dr. Lilienthal said that while the final result in this case had been extremely disappointing to him, there were enough cases on record in which the mixed toxins had produced a complete and apparently permanent cure to make it well worth while to make use of the remedy.

DR. COLEY, in reply to Dr. Lilienthal, said that speaking approximately, the mixed toxins had produced an apparent cure in from ten to fifteen per cent. of the cases that he had treated personally. When it is remembered that these were all inoperable, hopeless cases, the results are encouraging. The speaker said that formerly he had limited the use of the toxins to inoperable cases, but now he was becoming more strongly in favor of employing the remedy, as Dr. Lilienthal has suggested, as a prophylactic measure. He recalled one case, where, seven years ago, he had removed a small periosteal tumor of the finger, which was regarded as benign. Sections of the growth were submitted to Dr. Welch, of Baltimore, and two pathologists in this city, and all three pronounced it a small round-celled periosteal sarcoma. The advisability of amputating the finger then came up, but as the patient strongly objected to such a radical measure, the toxins were used as a prophylactic. This was seven years ago, and thus far there had been no signs of a recurrence.

Dr. Coley said he could recall about 20 cases in which toxins had been used as a prophylactic measure. A very large number of these patients were still well. He knew of others where they apparently had no effect on the progress of the disease. The only thing to do was to test them. He said he was confident that they did not cause metastases, and the case which he showed at a last meeting of the Society, a sarcoma of the femur, periosteal round-celled, with an enormous metastatic growth on the back and one in the pectoral region disappeared under the use of the toxins. And the patient was well four years proved that the toxin may be successfully used, even with extensive metastases. The action of the toxins is systemic, not local.

SARCOMA OF THE INGUINAL GLANDS, SIMULATING HODG-KIN'S DISEASE.

DR. COLEY presented a man, 37 years of age, who^m was admitted to the General Memorial Hospital on August 24, 1906, having been referred by Dr. A. G. Gerster as a case of inoperable sarcoma. Family history negative. The patient stated that he had always been in good health. Three years ago, he first noticed a small swelling in the right groin. This grew slowly until it reached the size of a walnut; was never painful and general health remained perfect. Five months prior to his admission the lumps in the groin began to increase in number and to grow rapidly in size. They finally interfered with his walking.

Physical examination at the time of his entrance to the hospital showed heart and lungs normal. His right inguinal region is occupied by a number of independent tumors, more or less closely fused and extending deeply into the iliac fossa. The skin over the growths was freely movable. The right thigh and leg were considerably swollen. Inasmuch as the tumor mass seemed so unusually movable, it seemed wise to attempt removal. This was done by Dr. Downes on Sept. 4, 1906. An incision, 9 ins. long, was made from the anterior superior spine, passing over the middle of Poupart's ligament and down along the course of the femoral vessels and a very large number of nodules, varying in size from a marble to a lemon, all more or less completely surrounded by a capsule, were removed. The peritoneum was opened accidentally in one place and closed with catgut sutures. The wound healed

satisfactorily, without suppuration. Microscopical examination of the growth, made by Dr. Clark, assistant pathologist of the hospital, and confirmed by Dr. Wood of the College of Physicians and Surgeons' laboratory pronounced it Hodgkin's disease. Portions of the tumor were also examined at Cornell laboratory and the same diagnosis was made.

Blood examination on May 7 showed: Red cells, 4,200,000; white cells, 51,000; polymorphous 35 per cent.; lymphocytes 65 per cent.; hæmoglobin 80 per cent.

After the wound had healed, the nucleo-proteid serum from a case of Hodgkin's disease, prepared by Dr. S. P. Beebe from the Huntington Laboratory Fund for Cancer Research, was begun. Nine tubes of 15 cc. each were given without apparent effect. Oct. 16 the serum was given up and the patient was put upon the mixed toxins of erysipelas and bacillus prodigiosus. Up to the present time 19 injections have been given in doses of $\frac{1}{2}$ mm. to 13 mm. at the present. On October 16 the right thigh measured $18\frac{1}{4}$ inches, being two inches larger than the left. Physical examination at that time showed the right inguinal and iliac regions occupied by a tumor which apparently infiltrated the adjacent structures, as its limits could not be well defined. In the right hypochondriac region, just to the right of the median line, there was a hard mass evidently attached to the spine and extending from the median line nearly over to the lumbar region and up almost to a level with the right costal arch. No enlargement of the spleen and liver could be detected. During the past month, under the toxin treatment, there has been some improvement in the abdominal condition; the tumor in the iliac fossa is somewhat smaller and the mass in the right hypochondrium is not nearly so pronounced. Measurements of the leg remain the same.

The principal reason for showing this case, he said, is that it emphasizes very clearly the striking similarity between Hodgkin's disease and sarcoma.

This case, together with a number of others, somewhat similar, which had come under his observation, had strengthened the opinion he had long held, that Hodgkin's disease is really a variety of sarcoma, rather than an independent disease.

DR. GEORGE E. BREWER said he had now under treatment a case almost identical with the one shown by Dr. Coley. The

patient had a large glandular tumor in the groin, sections of which had been removed and pronounced Hodgkin's disease. The accessory glands in other parts of the body were also enlarged. In a similar case observed last spring, the serum treatment was very satisfactory.

DR. ANDREW J. MCCOSH said he was inclined to agree with Dr. Coley that Hodgkin's disease resembled sarcoma far more than it did tuberculosis. He had recently operated for the third time on a middle-aged man who had enlarged glands in the neck and other parts of the body. The first operation was done about four years ago, at which time he removed a large number of glands which the pathologist declared to be lymphosarcoma. Eighteen months ago a second operation was done. A number of glands were again removed, and these were pronounced probably lymphosarcoma. Three weeks ago the third operation was done, and the same pathologist reported that the case was one of Hodgkin's disease, making no mention of lymphosarcoma.

The pathologist's reports in this case, Dr. McCosh said, went to show that either there must be considerable difficulty in distinguishing between the two conditions, or else that the tissues had undergone some change since the date of the previous examinations.

DR. BLAKE reported the case of a woman who had a number of enlarged glands in the neck and axillæ. Those in the neck were removed, and the pathologist pronounced the case one of Hodgkin's disease. Subsequently, some of the axillary glands were removed and were reported tubercular. Later on there was an enlargement over the ribs, and the development of a tubercular sinus connected with the thoracic cavity. Dr. Blake said that when he last saw the patient, she was dying, apparently of Hodgkin's disease.

RESECTION OF THE SHOULDER AND ELBOW FOR TUBERCULOSIS.

DR. WILLY MEYER presented a Swedish woman, 32 years old, who had been operated on at Stockholm a number of times for tuberculosis of the right shoulder and right elbow, from which she had suffered since her thirteenth year.

When Dr. Meyer first saw the patient, in October, 1897,

both of the affected joints showed a typical tuberculous inflammation. He first resected the shoulder, (October) and subsequently the elbow, according to the Kocher method (December). The functional result of both operations was excellent. The woman, whose occupation was that of a waitress, had a strong right arm which she could use for all purposes, excepting that she was unable to raise it fully, and that pronation and supination were also slightly impaired. The operations were done nine years ago.

Dr. Meyer said he considered the Kocher method of resection far superior to that of Langenbeck. The former gave an excellent exposure of the parts, and all the important attachments of the tendons were preserved.

END-TO-END ARTERIOVENOUS ANGEIORRAPHY.

Dr. HOWARD LILIENTHAL read a paper with the above title, for which see page 1.

Dr. BLAKE said that from a theoretical standpoint certain objections to the procedure described by Dr. Lilienthal had occurred to him. In the first place, the ligation of the femoral vein was dangerous even when the vessels were normal. Again, it seemed to him that when the femoral artery was attached to the vein, the blood would take the shortest course back by the anastomotic branches with the superficial abdominal veins and through the veins around the hip joint, and not circulate through the terminal veins of the extremity. Another objection would be a production of a pressure stasis throughout the veins of the limb.

Dr. JOHN B. WALKER said that during the meeting of the American Medical Association in Boston last June, a case was shown at the Boston City Hospital in which the femoral artery and vein had been divided, the upper end of the femoral artery had been sutured to the lower end of the femoral vein, the lower end of the femoral artery had been sutured to the upper end of the femoral vein. Primary union had occurred. The patient suffered from gangrene of the foot.

Dr. WILLY MEYER said the case referred to by Dr. Walker was probably that of Dr. Joshua C. Hubbard, of Boston, which was operated on in April, 1906, and described in the October, 1906, issue of the ANNALS OF SURGERY. In Dr. Hubbard's case

the patient, who was eighty years old, recovered from the operation, the femoral artery being cut and anastomosed to the vein and the vein divided and sutured to the artery. The procedure failed to check the gangrene. When the leg was amputated, about six weeks later, both the anterior and posterior tibials spurted arterial blood. The veins did not seem to carry arterial blood. The patient left the hospital in good condition.

Dr. Meyer also thought that such operations should be tested in the human subject in suitable cases, but he fears, that gangrene once having set in, can not be checked in this way.

DR. JOHN A. HARTWELL asked Dr Lilienthal whether Dr. Carrel, in his experimental work, had occluded the femoral artery by multiple ligatures, so as to prevent a return of the circulation through that vessel.

DR. LILIENTHAL, in closing the discussion, said he had considered this matter very carefully before he decided to risk the operation in the human subject. In reply to the theoretical objections raised by Dr. Blake, the speaker said that Dr. Carrel had succeeded in producing a complete reversal of the circulation, so that the veins carried arterial blood outwards, and the arteries carried venous blood back again. The blood, in its return course, did not necessarily take the shortest channel back to the heart; at least, that fact had been demonstrated in the normal animal. Whether it was so under pathological conditions, such as he had had to deal with, Dr. Lilienthal said he did not know. In a similar case in the future, if he found the popliteal artery occluded, he did not think he would again venture to operate higher up. Of the conditions he had mentioned in his paper in which the operation was perhaps justifiable, that of angeiosclerotic gangrene was the most hopeless. If there was a mortality attached to the operation, then, of course, it had no place, and amputation was preferable.

In reply to Dr. Hartwell, Dr. Lilienthal said that Carrel's work had been experimental, and limited to normal animals, and he was quite certain that he had not made any experiments that compared in a fair way with the pathological conditions that were encountered in this case.

REVIEWS OF BOOKS.

SURGERY: ITS PRINCIPLES AND PRACTISE. By Various Authors.

Edited by WILLIAM WILLIAMS KEEN, M.D., LL.D., Professor of the Principles of Surgery and of Clinical Surgery, Jefferson Medical College, Philadelphia. Vol. I, 8vo., pp. 983. W. B. Saunders Company, Philadelphia, 1906.

This is the first of a series of five volumes in which the editor, Professor Keen, with the help of more than three score collaborators, has proposed to present surgery as it is understood and practised to-day. As one runs over the names of the contributors, from Abbe to Young, if he is at all conversant with the men who are the leaders in the surgical activities and problems of the day, he can but feel that they represent the best which the present generation has produced, and one looks forward with a confident expectation of value and character in the treatise as a whole. The plan of the work and the selection of his collaborators is the fruit of the ripened judgment of the veteran teacher, author and surgeon, whose name the work as a whole must bear. It will remain as a fitting monument to his surgical genius and his practical abilities as a man of affairs. May he be spared long to enjoy the fruit of his labors and the applause and affection of his colleagues.

A very few transatlantic names are found in the list of authors: Bland-Sutton, of London, has prepared the chapter on Tumors. His neighbor, Edmund Owen, that on Diseases of the Mouth and Jaws. Mayo-Robson, on the Surgery of the Stomach, and Moynihan on the Surgery of the Pancreas and Spleen, complete the list of English surgeons that have been drawn upon. From the Continent, Albert Kocher, of Berne, is to deal with the Surgery of the Thyroid Gland, and Gottstein, of Breslau, that of the Esophagus. Lannander, of Upsala, presents Local Anæsthesia and Anæsthetics. This completes the tale. It is evident that the treatise will be so preponderantly American, that it will always be considered as such.

The publishers in their prospectus promise the appearance

of a volume every three months, until the whole work is completed. It is to be hoped that this assurance will be realized in the performance. It will be truly characteristic of cisatlantic energy and push, if it is done. The reviewer in a moment of weakness twenty-seven years ago enrolled himself as a subscriber to the series of volumes to compose the *Deutsche Chirurgie*, "Herausgegeben von Billroth und Luecke." The series is not completed yet! The volumes continue to come to hand from the German publisher at irregular intervals. The title pages now bear the inscription, "Begründet von Billroth und Lecke." Other names have succeeded to the responsibilities of the "Herausgegeben!" Each volume, however, as it has appeared has been complete and encyclopædic up to the date of its publication, and possesses a permanent value as a book of reference, if not as a guide to present practice. It is the latter element, however, which most appeals to the average American practitioner of medicine. He wants something for his present use and immediate practical guidance. In a previous generation Gross was the great teacher who personally dominated as a teacher of surgery, both in the amphitheater and as an author. There was a vigor, a directness, a personality to his great work, the two volumes of his system of surgery, that never failed to engage the interest and confidence of the reader. No subsequent writer has been able to "bend his bow," unless it be Fowler in those volumes which he left behind him as a record of his energy and his enthusiasm.

The last forty years have produced a series of most important and valuable surgical treatises by American authors and from American presses that have in succession well presented the conditions of surgical knowledge and practice of their respective dates: The *International Encyclopædia*, edited by Ashhurst; the system edited by Dennis and Billings; the scholarly volumes of Agnew; the condensed epitomes of Ashhurst, of Roberts, of Wyeth, of Da Costa and of Brewer; the great American text-book edited by Keen and White; the volumes of Park and of Warren, of Wharton and Curtis and of Fowler, together constitute a body of surgical teaching and practice of the highest interest and the greatest credit to the profession of this country. In the rapid development of the surgery of the present, the life of a surgical text-book is necessarily very brief. That publishers, shrewd men of business and

well acquainted with the field from which patronage is to be obtained, should at such short intervals be putting out from their presses such expensive publications as those already mentioned, of the recent past, to be succeeded now by such an one as this "Surgery" edited by Keen, or that which is now disputing with it the favor of the profession, the series edited by Bryant, speaks well for the intelligence and enterprise of the medical men of the country who are to be the buyers of these expensive books, and to whom it is simply requisite that a book should be the best and the latest to secure its purchase whatever its cost.

The introductory chapter in this first volume of Keen's Surgery is by James G. Mumford, of Boston, and is entitled "Narrative of Surgery: A Historical Sketch." It is good reading. The style is animated and the descriptions are most interesting. Hippocrates and Galen receive due mention, and then a skip is made over fifteen hundred years to Vesalius. We could wish that this able pen could have said something about the Schools of Salerno, of Bologna, of Montpellier; of such surgeons as Mondeville, de Chauliac, Argelata, Berengarius da Carpi, and that he might have gone a little more into detail as regards the work which the Arabians did, all in this interval between Galen and Vesalius. The hiatus is too great. Our modern surgeons need to be informed as to the development and traditions of their art, and who so well fitted to do it as the accomplished and learned author of this chapter?

The remaining chapters of this volume are devoted, as would be expected, to topics pertaining to the Principles of Surgery and to General Surgery. A good index closes the volume. The merits of the book are such as will make one anxious for the appearance of its successors.

LEWIS S. PILCHER.

A TEXT-BOOK OF GENITO-URINARY DISEASES. By DR. LEOPOLD CASPER, Professor in the University of Berlin. Translated and edited with additions, by DR. CHARLES W. BONNEY, of Philadelphia. P. Blakiston's Son & Co., Philadelphia, 1906.

Doctor Leopold Casper, the author of this treatise, is a recognized authority on the subject of genito-urinary diseases. He is without question an enthusiast on the subject, as all those who

have studied under him will acknowledge. He is an indefatigable worker and a logical and scientific thinker. In his clinic in Berlin one sees all classes of genito-urinary diseases. As a teacher he has the art of imparting to his students a clear insight into the subject which he presents.

In his book this same enthusiasm and clearness is very evident. He divides his book into a General and a Special Section. In the General Section are considered the Examination of the Patient, Anatomy and Physiology of the Genito-Urinary Tract, Physical Methods of Examination, and Physical, Chemical and Microscopical Examination of the Secretions. This may seem to be but a repetition of what many other authors have already presented, but when one studies this section carefully he is impressed with the originality and value of the treatise as coming from the pen of a man who has actually done the work, and has excluded many of the worthless and time-consuming methods which other authors still cling to.

The Special Section treats of the various Diseases of the Genito-Urinary Tract and of the Functional Disturbances of the Sexual Organs.

The discussion of radical operations for hypertrophy of the prostate has been written conjointly by the author and Charles W. Bonney, the latter having translated the German edition, and edited the present American edition.

The book is eminently practical, and will rank high among the text-books on Genito-Urinary Diseases.

SURGICAL ASPECTS OF DIGESTIVE DISORDERS. By JAMES G. MUMFORD, M.D., Surgeon to the Massachusetts General Hospital, etc., and ARTHUR K. STONE, M.D., Physician to Out Patients, Massachusetts General Hospital, etc. 8vo., pp. 395. The Macmillan Company, 1905.

The era that dawned with the operative treatment of appendicitis, and whose light brightened with the recognition of gall-bladder disease as a surgical affection, has lightened more and more as Moynihan, Robson, the Mayos and others have published their successes in the operative relief of other chronic abdominal conditions, especially those affecting the stomach and intestines. As one turns the pages of the work now under consideration the

conviction grows that the field of the internalist is rapidly being narrowed and that the day of pills and potions is passing.

If one were to find nothing more in Professor Mumford's pages than his review of medical history it would sufficiently demonstrate how recent is any real knowledge of diseases of the stomach, and how rapidly such knowledge has placed a large proportion of gastric complaints in the list of mechanical disorders that demand for their relief not medicine but the knife. One feels as he reads an enthusiasm that urges him to recommend all his patients to have their abdominal organs repaired and rearranged, and it is not until some time has elapsed that sober afterthought raises a question as to whether we are yet sufficiently experienced to see such surgical treatment in its true perspective.

This much seems certain: A number of chronic gastric diseases, including chronic ulcer, dilatation with stagnation, gastric tetany, and some others, are markedly benefited by gastro-enterotomy. The pain subsides, the nervous symptoms disappear, and the patient regains his health and strength.

The authors discuss these questions at some length and present a number of statistics from various sources bearing on both sides, for and against operation. They instance the frequency with which cancer of the stomach is overlooked, dwell on the deplorable inadequacy of late operation for its relief, discuss the symptoms and diagnosis somewhat fully, and conclude that exploratory laparotomy should be more frequently undertaken.

Interesting chapters are devoted to the bile passages and the pancreas. Glénard's disease with the other abdominal ptoses receives intelligent discussion, and the appendix comes in for an extended consideration, especially chronic appendicitis and the results of operation. A number of interesting records are cited showing how previously unsuspected chronic appendicitis with only mild inflammation and adhesions seemed responsible for a variety of digestive disturbances, and how operation gave relief.

Dr. Henry F. Hewes furnishes an interesting and valuable—because complete and concise—appendix dealing with the diagnosis and significance of gastrectasis, of gastric ulcer and cancer, and containing the records of a number of gastric cases with clinical and postmortem finding.

It is to be regretted that a book so full of excellence should

be somewhat marred by the style in which it is written. The sentences are often involved and there is a frequent abrupt change of subject that demands so close attention on the reader's part as to cause him to occasionally lose the meaning. The importance of the subject and the judicious way in which it is presented, however, more than counterbalance this literary defect and are recommendation enough without reviewer's comment.

HENRY GOODWIN WEBSTER.

ATLAS AND TEXT-BOOK OF HUMAN ANATOMY. Volume I. By PROFESSOR J. SOBOTTA, of Wurzburg. Edited, with additions, by J. PLAYFAIR McMURRICH, A.M., Ph.D., Professor of Anatomy at the University of Michigan, Ann Arbor. Quarto, 258 pages. Philadelphia and London: W. B. SAUNDERS COMPANY, 1906.

Prof. Sobotta's aim in preparing this atlas has been to provide a work which should be practical and not too comprehensive, furnishing illustrations true to nature, and especially adapted to the use of medical students in the dissecting room. It is not an atlas for the finished anatomist, and can not be classed with the more extensive work of Toldt.

In the original German edition, the text and atlas were separate volumes, and in preparing the English edition Prof. McMurrich has united the text and atlas in a common volume. The nomenclature employed is essentially that proposed by the Basel Committee on Anatomical Nomenclature, most of the terms being anglicized. It is entirely different from most text-books of anatomy, in that it is a descriptive atlas.

Volume I treats of the Bones, Ligaments, Joints and Muscles. As might be expected in such a work, the illustrations are the most striking features; multicolor lithography has been extensively employed, and almost the entire myology has been illustrated in this manner. The other illustrations are mostly half-tones, and all of them are accurate and most excellently executed.

It is to be regretted that in the section on Osteology, the illustrations do not indicate the points of attachment of the muscles to the bones. This is always a most puzzling question for the student to solve, and should be considered in compiling such a work. The descriptions, however, of the bones are

clear and comprehensive. The sections on Joints and Muscles are beyond criticism. The work, as a descriptive atlas, leaves nothing to be desired.

PAUL PILCHER.

DISEASES OF THE DIGESTIVE SYSTEM. Edited by FRANK BILLINGS, M.D., 8vo., pp. 824. D. Appleton & Company, New York, 1906.

"Die Deutsche Klinik," edited by Julius L. Salinger, M.D., is being made available for English readers in the series of volumes on Modern Clinical Medicine, now three in number, of which the present volume is one. The list of contributors is perhaps the best critique of its merits: Ewald, Boas, Hoppe-Seyler, Nothnagel, Leo, Strauss, Neusser, Rosenheim, Riegel, Hirschfeld, Oser, Minkowski, Stadelmann, Kraus, Fleiner, Vierordt, Strasburger. One can add nothing to the authority with which these men speak.

The chapters of this work are each complete separate articles contributed by the clinicians mentioned, independent but correlated by the general subject of digestive diseases.

If one were to choose from among so many noteworthy contributions, possibly the one by Oser, of Vienna, on the Symptomatology of the Diseases of the Pancreas would first arrest attention, if only on account of the obscurity from which pancreatic diseases and their determination are just emerging. Associated as it is with the liver, deeply hidden in the abdomen and so difficult of digital appreciation, it has been long neglected, even in necropsies; while its rapid self-digestion post mortem has helped to obscure its pathology.

Recent work on the normal and abnormal constitution of the fæces and on the physiology of proteid and hydrocarbon digestion has directed attention to the functions of the pancreas and seems to offer certain points of diagnostic value in the estimation of pancreatic activity. Collective reports on the pathology of the organ have demonstrated its relation to some forms of diabetes, so that the analysis of the urine offers some help. The conclusions drawn in Oser's article are these: Pancreatic disease may be reasonably assumed when examination of the fæces shows a disturbance in the digestion of albumin as

evidenced by undigested meat, and insufficient fat digestion, other causes being discounted. The details of the article cannot be considered here.

An exceedingly interesting contribution is that by Riegel on the diagnosis and treatment of gastric dilatation, as is one by Ewald on gastric ulcer and gastric hæmorrhage. The latter modestly points to a personal experience of over 1250 cases. The etiology he declares to be not yet satisfactorily explained, except where direct trauma can be proven. A valuable table comparing the symptoms of nervous gastralgia, ulcer and cancer is included. Under Treatment he advocates in general the method by large doses of bismuth in suspension, appropriate diet and laxative alkaline drinks—as Carlsbad water. Surgical intervention is advocated only after persistent medical efforts have failed, and in selected cases.

The section on the examination of the fæces, by Strasburger, is remarkable for its excellent illustrations—many in color—of normal and abnormal fæcal constituents. Its brevity is compensated for by its lucid presentation.

Fleiner presents an excellent contribution on diarrhœa, intestinal catarrh and intestinal tuberculosis; Boas one on constipation and hæmorrhoids, and Vierordt one on acute diffuse peritonitis, appendicitis and perityphilitis. Space prevents enumeration and discussion of the other articles, all of which are notable.

The work will prove a valuable addition to every working library.

HENRY GOODWIN WEBSTER.

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ORIGINAL MEMOIRS.

SEQUESTRATION ANÆMIA IN BRAIN AND SKULL SURGERY.

BY ROBERT H. M. DAWBARN, M.D.,

OF NEW YORK.

Professor of Surgery in the New York Polyclinic Medical School; Surgeon to the City Hospital of New York.

OF all the operative causes of shock, admittedly the first and chief is hæmorrhage. Indeed, it has been said by able clinicians that shock is only another name for hæmorrhage.*

The older a surgeon the greater becomes his respect for a drop of blood.

It seems strange that careful as we all are to apply this principle in cutting work upon the limbs, it has apparently been overlooked (as to cording) elsewhere. For example, prior to any bloody operation whatever upon an extremity, we elevate and accumulate in the trunk, neck and head, by gravity, and sometimes also by centripetal massage, most of its blood; and then by cordage near the trunk maintain anæmia during the cutting. But what surgeon about to operate on however vascular a field of the head, the neck or the body, ever applies this same principle—and to avoid hæmorrhage accumulates blood in the extremities? Nobody, for this purpose, so far

* Crile on Surgical Shock, p. 138. (Explaining, however, that in reality hæmorrhage may be only one important factor in shock causation.)

as I am aware. And yet if wise in the one instance it is (at least as to preventing bleeding) obviously so in the other. To be sure we cannot deprive the other parts of blood to anything like the same degree that we employ in dealing with the members. Nevertheless, experience shows that we can with entire safety withdraw into the limbs some quarts of the whole bulk which constitutes one-thirteenth of the individual's weight. We can sequestrate before operation and retain in the limbs by cordage enough to make a striking difference in loss of blood from the operative field; enough, indeed, as the writer has convinced himself, to constitute in many cases the difference between life and death, between shock and absence of shock, in a gravely severe case.

This temporary bleeding, so to call it, into the patient's own extremities, is controlled as to degree, by the finger of an assistant upon the pulse. Its original volume and force being estimated, the sequestration proceeds until there is a plainly noticeable softening and lessening of tension. At this point begins the operation; and every cut vessel spurts less than otherwise would be the case. Indeed, were we unwisely to carry the plan to its limits, hardly any hæmorrhage would occur, but the patient's heart would beat so feebly as to cause him to faint away. Many a case, for instance, of attempted suicide from cut-throat has lived because of this, firm clotting occurring meanwhile at the mouths of the severed vessels. And as to effect upon respiration, this is proportionate to the extent of the bleeding, whether actual or into the patient's limbs, the breathing being always both accelerated and deepened.

But of course no such extreme is advised; simply a noticeable degree of pulse softening. If we reduce by even a moderate amount the quantity of blood otherwise surely lost, the gain in safety is obvious. Should the anæsthetist observe a tendency toward cardiac weakness it is easy almost instantly, by release of cordage, to produce a distinct improvement both as to force and number of heart beats.

This report is in the nature of a preliminary one. I am

experimenting as to whether by the circumference of the limbs taken before accumulation and again later on we can estimate the relative amount of blood withdrawn. It is possible that by testing the blood-pressure before and after withdrawal into the limbs, using by choice the Riva Rocci apparatus with Cushing's improvements, the assistant may reach more accurate estimates than thus far have been attained. However, in no case out of many (including therein work upon the neck, chest, abdomen and pelvis, as well as a much smaller number upon the skull), has the writer thus far cause to regret using the plan. It is not, then, because of simply theoretical advantages that it is now brought forward, but because it has practically been found a means of safeguard and reliance. And it can now be spoken of in terms which at first would not have been justifiable.*

The technique is as follows: A towel folded lengthwise is wrapped about each thigh very close to the trunk, and upon this the rubber tube is tightened. The towel serves in a measure to prevent subsequent discomfort, by spreading the pressure over a wider area. The degree of tightness is quickly learned by practice. It must nearly stop the venous but not the arterial current. Quickly the limb distal to the tourniquet grows dusky in color and there is obvious swelling also. After from five to ten minutes, according to the tightness of the cord, the softened pulse will indicate that we are ready to proceed with operating. The congested limbs are, however, first warmly wrapped, and hot-water bags placed about them.

In case the effect of the major anæsthesia is feared, in a given instance, these steps may be taken with a conscious patient, in order to form a reserve-guard of pure blood. And if then during operation failing respiration or other cause seem to justify it, removal of cord and elevation of limb or

* The writer distinctly states that he makes no claim for originality as to cording for the arrest of *accidental* hæmorrhage, either surgical or medical. As to the latter he would again call attention to a much neglected subject. See his paper in the Proceedings of the Surgical Society of the New York Academy of Medicine, Nov. 9, 1891.

limbs will pour quarts, literally, of fresh blood into the narcotized, and the patient will awaken almost at once.* But as a rule, to avoid discomfort, nothing is done until the subject is asleep.

When at first the writer began experimenting in blood sequestration a less simple plan was thought essential. Two limbs being swollen, the cord was tightened so that no further blood could enter, nor any escape. So far as a study of literature could guide, no case was discovered where absolute stagnation of healthy blood within a healthy limb for as short a period as a half hour had been followed by gangrene; but for safety, after fifteen minutes (if the operation must be longer) the assistant, trained to this purpose, began cording the remaining two limbs, almost at the same time commencing to release those first constricted; and in a long operation this shifting from arms to thighs, and back again, was done repeatedly. But after a time it seemed that we might obtain equally good results with less trouble; and since then the tube has been left so placed, as to degree of tension, that continually some blood enters—for the pulse is not wholly shut off—and of course some blood also escapes into the trunk. Only in case the limbs grow excessively swollen, or the pulse demands a change, is the tension altered during the operation. In a few plethoric individuals I have used constriction of all four extremities at once in this way. But generally cording the lower ones only—at the groin—has sufficed to accomplish much good in the way of blood saving.

Obviously, the ultimate return of so much blood into the general circulation ought not to be accomplished instantly. For the sake of the heart, the cords should be loosened rather slowly, taking nearly as long to release as to accumulate the blood.

* Of course for this purpose the idea is not at all new. It was first suggested (*re* anæsthesia, by Dr. David Webster in the N. Y. Med. Journal in 1887, and was tried by the writer within a month later. See also Atlanta Med. and Surg. Journal, Aug., Sept. and Oct., 1897,—articles upon Anæsthesia.

The question naturally arises at this point whether, as this is done, the restoration of the usual pressure will not be accompanied by so much spurting from a myriad cut vessels—if the field be large—that finally little would really be gained in saving of blood. Undoubtedly this would be the result if nothing further were to be suggested. But as a regular part of the procedure under discussion we must, before releasing the tourniquets, clot firmly the blood in the mouth of every divided vessel by the following step—to be considered the necessary corollary of what has gone before, and always to be used after it. I refer to an application of gauze sponges wrung dry, with the rubber-gloved hand, out of actually boiling water brought at this moment to the operating table. Not “hot” water, but water at 212 degrees F. No one need fear ill results to even the most delicate tissues of the human body from a few seconds’ firm application of gauze at this degree of heat—the brain perhaps excepted.* And, in consequence, not only is bleeding prevented, but the entire raw surface turns white from coagulated albumen, sterilizing it if it was not sterile before. And thereafter, if contaminated by ichorous

* The author has not as yet tested upon animals’ brains the effects of brief contact at a boiling temperature; but as to nerves has done so, and they are not injuriously affected, if only a few seconds elapse in such contact. It was only after such experimentation that the following operation was performed. Upon October 11, 1906, at Dr. John A. Wyeth’s clinic at the N. Y. Polyclinic Medical School the author excised from the left side of the neck of a man of thirty a cancerous growth so extensive as to require the removal, in the mass, of practically the entire length of the deep jugular vein. The pneumogastric nerve was saved. During manipulation several suppurating lymph-nodes ruptured, infecting the large wound, which was first cleansed by irrigation as usual, then dried, and filled for fifteen seconds with water actually boiling when taken from the fire, across the room. As in the dog, so here, an instant effect was noticeable. The patient’s breathing was made much deeper and more rapid; also the heart’s force was distinctly increased and the frequency was somewhat lessened. These effects upon the pneumogastric were observable for from three to five minutes. The wound was closed except for a narrow gutta-percha tissue drain introduced at the lowest point through a counter opening above the shoulder; and it quickly healed by primary union throughout. No subsequent adverse effect upon the nerve was observable. In repeated cases the writer has used the steaming

pus or septic fluids from the mouth or bladder, for instance, we are reasonably safe from danger of extension of such infection—very much as the surgeon feels regarding such a risk when once his wound is covered with healthy granulations.

Of course it is necessary, in order to prevent blisters, to avoid contact with skin or mucous surfaces. And obviously a very long application might, so to speak, cook the flesh. But used as advised, the writer has never had cause to be other than pleased with the result of employing this very old but much neglected application of heat.

Since atmospheric pressure makes such a difference in the temperature of boiling water, at high altitudes such as Denver it would be necessary for the best results to use water heated under pressure.†

Among the advantages of sequestration surgery (if I may use this term, simply to avoid a long periphrasis, whenever in this paper I must refer to it) in brain work its striking lowering of intracranial pressure is not the least. Where a brain tumor is to be operated upon, for one example among a num-

gauze pressed for a few seconds—or even boiling water—in direct contact with the deep jugular vein; the youngest, a baby of a year old, immediately following removal of tubercular lymph-nodes; this was a patient of Dr. William A. Ewing, of this city, who assisted. There were no objectionable results; the venous current was too rapid to permit of heat clotting—and the infected wounds healed per primam.

In the pneumogastric case just discussed the author ended by doing his starvation operation (excision of the external carotid and its branches, with paraffin plugging of the terminal two).

Dr. Wyeth, who was present, remarked to the class of graduate students, that for the kind and size of operation the wound had been dryer—there had been less bleeding—than he had ever seen before. This we quote simply as bearing upon the technique under discussion, for this operation was done with corded lower limbs.

† It may be suggested that heat so employed may well take the place of Harrington's fluid, as sealing cut lymphatics and bloodvessels without use of irritant chemicals. Also prior to use of Mosetig Moorhof's bone-cavity filling, it will stop bleeding without harm—instead of the use of dry air at burning temperature pumped in, which risks superficial necrosis from the presence of a red-hot point close to or within the bone cavity, meanwhile. Of course the cavity must next be carefully dried, before introducing Moorhof's filling.

ber, a great risk of sudden death is thus avoided. To quote Sir Victor Horsley *: "Moreover, all cases of increased intracranial tension (as is now well recognized) are liable to die at any moment of sudden paralysis of the respiratory centre. How often one sees this accident in cases of intracranial tumor who are only at the very last transferred for surgical treatment!" Crile,† too, names excessive intracranial pressure first among causes of collapse due to injuries or operations affecting base of brain and medulla.

Horsley objects to ether because it invites more hæmorrhage in brain operation. And yet, though advocating chloroform, admits its greater toxicity to nerve-tissue. He adds: "In the literature of the early days of cerebral surgery may be found instances of death upon the operating table, which I have no doubt were due to failure of the respiratory centre owing to a dose of chloroform having been given which, though perhaps not necessarily lethal in an ordinary case, was fully so to a patient whose bulb was hampered by previous tumor pressure." It must be obvious that the plan we are herein advocating is a distinct safeguard to some degree against the danger mentioned from each of these drugs, and from pressure. And, conversely, in brain operations where already the pressure is dangerous (as in instances just quoted) Crile's pneumatic suit would obviously add to the risk unless indeed both of the common or the internal carotids be controlled as he suggests.

It is important in connection with Horsley's paper to note his method (*loc. cit.*) of treatment of hæmorrhage during brain work of the kind chiefly annoying—venous and capillary oozing, due to chloroform asphyxia, which raises the intravenous pressure—he adds a stream of oxygen to his chloroform vapor. "It is interesting," he says, "to see how rapidly the bleeding stops as the color of the oozing blood changes from dark purple to bright scarlet. I frequently, therefore, during operation, especially toward the end, request

* British Med. Journal, Aug. 23, 1906.

† Surgical Shock, p. 151.

the anæsthetist to turn on the oxygen for this purpose as well as for the elimination of shock."

For this interesting and valuable discovery we are thankful; but as to the following from the same paper, it is perhaps not beyond a mild criticism: "When the brain is obviously turgid with congestion I always ask that the chloroform percentage should be raised for, say, a quarter to half a minute, to one or two per cent. This at once induces a convenient, proportionate, and of course temporary anæmia" (by causing a fall in blood-pressure). Plainly, as sequestration does the same thing, we have in it "the ounce of prevention," and no need to push chloroform at all.

In controlling arteriole and capillary brain hæmorrhage, Horsley's favorite plan is hot water irrigation at a temperature "which should not exceed 115° F. nor fall below 110° F." He fears that if 120° be used, heat coagulation of the cut surface of the brain would result.

During a very recent visit to the Mayos at Rochester, Minn., the writer found Dr. Charles Mayo employing what is in effect the same idea as his own, in otherwise very bloody work upon head or neck. He employs *gravity* sequestration, however, instead of cordage. His patient is seated in a nearly upright posture, and Dr. Mayo stands upon a stool in order to be high enough to reach the field of operation. Obviously if there are any objections to be offered to the plan by sequestration they apply equally here; but Dr. Mayo has had no reason to regret adopting this idea. However, were chloroform to be the anæsthetic chosen, the upright attitude would self-evidently be unsafe because of its effect upon the heart. It is for this reason that its employment by dentists in the dental chair has been followed by fatalities not otherwise explicable.

In addition to Horsley's and Mayo's ideas as to control of hæmorrhage in this operative field we must refer to the recent suggestion of Dr. George W. Crile, in his paper read at Boston last June, in which he advocated in addition to "a head-up inclined posture," and his rubber pneumatic suit, exposing

and applying temporary clamps to the common carotids; to be released as soon as the operation is completed. This last he also suggested in his work upon Blood Pressure.*

Thus far we have said nothing regarding a question which has doubtless occurred to all—namely, does sequestration-anæmia threaten shock?—depriving as it does, however, temporarily, the brain and heart of a considerable part of the blood.

The answer, based upon more than two years of trial in my practice, and covering many regions of head, neck, and trunk, is in the negative.

In all that we do as surgeons we are always selecting the lesser of (at least) two evils; and although—stated as a general principle—it seems desirable to keep the vasotonic centre well supplied with blood, yet there is evidence at hand that in numerous instances so brief a partial anæmia as that during an operation is well borne; and that, as compared with avoidable loss of considerable blood, in these instances the sequestration constitutes the lesser evil.

* Dr. Crile says in this essay (*Journ. Am. Med. Assoc.*, Dec. 1, 1906): "In 61 cases I have temporarily closed the common or external carotid without immediate or remote consequences."

This leaves us in the dark as to their relative frequency. It is surprising that so serious and so safe a vessel should be classed together in this indifferent way. Even temporary closing of the common—but long enough for the extensive operation required in radical cancer work in the neck—I should consider not justifiable when the same result, namely a dry operation, can be obtained in a less questionable way.

Not long since Dr. Charles Mayo remarked that in the neck there are just two structures which he holds in implicit respect and lets alone. One of these is the parathyroid bodies—the other, the common carotids of the elderly (which is the age requiring cancer operation). Dr. John A. Wyeth in his *Am. Med. Assn. Prize Essay* puts the mortality from closing of the common carotid at 40 per cent. Of course, however, this does not mean temporary clamping.

But as to such clamping, or even definitive ligation, of the *external* carotid, this is a measure as wholly devoid of risk as anything surgical can well be. I say this after using it about seventy-five times, of which more than fifty are given in detail (plus excision of this vessel) in my *Gross Prize Essay*, which upon p. 105 discusses this question. To speak as Crile does of it, as having a mortality rate of 2 per cent. from the washing away of the thrombus of the ligated stump *causing cerebral*

Indeed, if we reflect upon the main causes of operative shock, it is demonstrable that sequestration helps to a marked degree to prevent each of these. Omitting psychic causes, also needless rough handling, and the obvious fact that it follows work in certain regions more than in others, there may be said to be four main sources of shock due to surgery. These are: (1) Bleeding; (2) length of operation; (3) excess of major anæsthesia; (4) loss of vital heat.

As to the first of these, the advantage from sequestration has to be seen to be believed. The difference between excision of the upper jaw, for instance, accomplished with this step, and the same without, would be convincing enough in itself.

(2) As to length of operation, certainly a dry field has everything to do with this.

(3) Major anæsthesia, as every surgeon knows, is an important cause both as to depth and duration; and if, as will be proven by histories adduced herewith, in a brain operation, for example, the patient once under will, at least in some cases, remain so for long periods, just from anæmia similar to that in natural sleep, we have eliminated, in every minute so devoid of drugging, just so much risk of shock.

embolism, is simply to state an anatomical impossibility, as it does not supply the brain. Other writers have made the same curious error. I do not doubt that the occasional deaths with brain symptoms following supposed ligations of this vessel have been due to the commonest of its numerous anomalies, and the one which is the rule in dogs, namely, that there was no external carotid, or one insignificant in size, but that instead the internal, on its way to supply the brain and eye, gave off in the neck all the branches usually derived from the external carotid. (See author's Gross Prize Essay, pp. 142-143, also Chapter VII.)

I have myself cost the life of one of my earliest cases by this very blunder, with its resultant extreme anæmia of the brain. I tied, above the level of the common carotid that vessel which when controlled stops pulsation both in the facial and superficial temporal arteries; but this, the customary test, is unfortunately not at all reliable.

There are but two which are trustworthy: (1) finding a frank bifurcation of the common carotid; and (2) instant contraction of the pupil on the ligated side, where this precautionary search has been neglected, when it may not be too late to undo the damage by promptly cutting the ligature. Also, this second test can be used, doubtless safely, by intentional stoppage of circulation with the finger-tip and noting the effect, or absence of it, upon the pupil.

(4) As is well known, ether and chloroform reduce temperature markedly. Hare has shown that ether very quickly brings it down two degrees Fahrenheit below normal. Consequently, by cutting off necessity for prolonged breathing of ether we prevent this factor in shock.*

However, should any indications threatening shock appear—such as undue rapidity, weakness or irregularity of rhythm of pulse—it would be as simple as possible to end them by releasing one or both tourniquets; doing it gradually, to give the heart a little time in which to meet its added duty.

ILLUSTRATIVE CASES.

CASE I.—*Excision of Cerebellar Tumor.* This was a farmer, Mr. A. A. K., æt. 60, married, denies history of venereal. A patient of Dr. E. A. Schnell, of Round Hill, Conn. This patient seen, and subsequently operated upon, at his home in the country, Valhalla, N. Y., gave the following history: For the past six months, at least, he had complained of headache of increasing severity, located in his occiput, right side, low down. This was accompanied by an increasing inability to walk, due chiefly to dizziness. His stomach was upset, and he had frequent attacks of projectile vomiting. Also his sight was rapidly failing.

This made a picture so indicative of cerebellum tumor that I advised calling in the services of Dr. James A. Meeks, an oculist, who reported choked disc, and advised in favor of immediate operation.

This was performed on May 10, 1905, by the writer, assisted by Prof. George F. Shiels, formerly of the University of California, and by Drs. W. L. Griswold and John A. Clark, of Greenwich, Conn. Ether was the anæsthetic employed. With the trephine followed by the Devilbiss rongeur a large aperture was made exposing the right lobe of the cerebellum. An indurated portion of this was located, not encapsulated, and extending so far as the test by needle could determine, over an area of irregular contour, but perhaps involving one-third of this half of the

* Dr. R. C. Kemp's suggestion of keeping the rectum and colon filled with very hot normal salt solution during operations in general, using his rectal tube and an irrigator, deserves a more thorough trial than it has received.

hind brain. All this indurated portion was excised. It proved to be a glioma. The patient had hardly any bleeding, thanks to the accumulation of blood in his lower limbs; and, what surprised us all, once asleep he needed no more ether during all the time of operation—just three-quarters of an hour. He lay sleeping quietly, without stertor, and quite as if the natural anæmia existent during normal sleep were the determining factor in that condition rather than an artificially produced anæmia.

His recovery was without incident; and accompanied by a rapid improvement in all his symptoms. But when about a month had elapsed and he was once more up and about, in passing a catheter to relieve a prostatic congestion which troubled him occasionally, he infected himself; and the cystitis rapidly spread up the ureters, causing “surgical kidneys” and prompt death from suppression.

This outcome is recorded to give a full report; but surely the case may properly be classed as a success so far as the reason for operation is concerned; as also regarding the value of the method by cordage.

As to the advantage of avoidance, because of this, of the need for prolonged exhibition of ether or chloroform, when one reflects upon the usual risk of hæmorrhage from the delicate leptomeningeal vessels during the cerebral congestion accompanying vomiting after brain operations, and of hernia cerebri from bursting of the sutures in the dura, from the same cause, prevention of these risks seems indeed a distinct gain.

Regarding the duration of this operation without fresh anæsthesia and yet without pain or returning reflexes, for three-quarters of an hour of operation, we recognize of course that work upon any portion of the encephalon, once the dura is penetrated, is painless, except in the tract of any of the sensory cranial nerves, or along the course of the fillet. Perhaps brain work in a sensitive region would have compelled resumption of the anæsthetic sooner. But the longest period during which Sir Victor Horsley, for example, has been able to operate upon a cerebellar growth without necessity for renewal administration of the anæsthetic has been twelve to fifteen minutes

(loc. cit.). In the final case recorded in this paper the same complete success as to anæsthesia will be found noted. It has also been observed in other than head operations.

Though this was by no means an early instance of my employment of sequestration, it was the first in brain-work, and the earliest in which it occurred to me to try whether the moderate brain-anæmia might not suffice to maintain operative analgesia—once the patient was fully narcotized as usual.

CASE II (Operations 2 and 3).—*Trephining for Extradural Hæmorrhage.* Mr. F. S., American, æt. 30; telegrapher, single, denies venereal history. First seen by the writer November 21, 1905, in his service at the City Hospital, twelve days after receiving a single severe blow upon the right side of the head from a club. No clear history obtainable as to his condition during the interval between the injury and admission—except that he complained of much headache and seemed increasingly stupid. Those about him were very unobservant people. When attention was first drawn to him he had a temperature of 102° F., rectal, and he was suffering from severe clonic convulsions, chiefly of his entire left side; to a lesser degree also upon his right half. He was wholly unconscious, and had gradually become unable to be aroused, during the past three days of the twelve. Both eyes were directed sharply toward his right; pupils equal and of normal size. Had a moderate degree of Cheyne-Stokes respiration. The shaven skull presented evidence of but one wound, quite superficial and partly healed. This was about 5 cm. in length and situate over the middle of the right Rolandic fissure.

Evidently this man was suffering from pressure upon his brain; and the temperature of 102 led me to the erroneous diagnosis that we should find as cause, between dura and skull, the products of inflammation—fibrin, serum and pus. Instead, nothing was there but a large clot from rupture of the middle meningeal. And slowly the bleeding had increased the pressure until the convulsions, etc., appeared.

In a recent article upon brain surgery Dr. M. Allen Starr* in discussing extra dural hæmorrhage asserts without qualification

* Jour. Am. Med. Assn., Sept. 22, 1906.

that the symptoms develop within six hours after the injury. Here is a case infinitely slower; and I have operated upon several where a few days had elapsed. It is plain that the time is dependent chiefly upon (a) the size of the broken arteriole and (b) upon what region of dura is being stripped up. In the temporal fossa this membrane is least firmly attached to the bone. Starr, in the same article, considers that when the hemiplegia, for instance, "does not come to its height for three or four days it is probable that there is a *surface hæmorrhage* due to the injury of a vein of the pia mater. A lumbar puncture will reveal bloody cerebro-spinal fluid." As stated, I am convinced that hemiplegia so developing in point of time would more often be explained as just mentioned. However, certainly lumbar puncture would be of unquestionable value simply in confirming a diagnosis of hæmorrhage; although the indication to enter the skull promptly for relief of pressure would exist equally in either case.*

Regarding the question at which probable level beneath the skull a surgical hæmorrhage has occurred, perhaps it may be of interest to note how wide a difference of opinion is found even among surgeons of wide experience. From without inward:

(I) Deaver asserts † that all cases seen by him have been subcranial—(i.e., between dura and skull); and he adds that so easily is the dura of the temporal fossa separated from its bone that, given a ruptured branch of the middle meningeal, this will happen without any fracture whatever.

(II) *Subdural* (i.e., between dura and arachnoid). According to the English surgeon, Prescott Hewitt, this is the commonest variety.

(III) *Subarachnoid* (and into the meshes of the pia mater). Erichsen states that the commonest variety is at this level. (I do not imagine that it is possible to differentiate, practically, (II) from (III), and probably Hewitt and Erichsen mean one and the same thing.)

(IV) Into the substance of the brain or its ventricles; i.e., true apoplexy. Unquestionably the rarest of these four, as a result of traumatism.

* Blood-tinged cerebro-spinal fluid withdrawn by lumbar puncture is a valuable sign of fracture at the base of the skull.

† Phila. Med. News, Feb. 15, 1890.

Returning to our patient. Operation, under ether, assisted by the House Staff, November 21, within an hour after the case was reported to me. Cordage for sequestration. Incision upon his right. Upon exposure of the bone, an undepressed fracture was at once evident, beginning slightly lower than the level of the skin abrasion, and extending roughly along the Rolandic line, and thence steadily downward and forward across the base of the skull further than could be followed. On removal of bone with the Devilbiss rongeur, a very extensive and thick bloodclot was exposed—plainly the source of the left hemiplegic convulsions. Its upper part was quite firm and partly organized, more so than that lying at the base, and which latter, was evidently more recent. Irrigation alone was ineffective; nothing short of the blunt curette sufficed to break up and dislodge the clot. Much bone had to be sacrificed to get room to do this work; and for this the temporal muscle was split clear down to the zygoma and its edges widely retracted. The handle of the curette was bent nearly to a semicircle, to permit scraping away the thick clot which was continuous right across the base, and even then its limits could not be reached. From some point at the very base blood welled up at the seat of fracture, as soon as the clot was dislodged there. This was controlled by packing down against this point a thin strip of damp gauze well rubbed with glutol (formalin gelatin, powdered). This was removed five days later without starting up the bleeding (two attempts, one upon the third, one the fourth day had showed that we must still wait).

There was no recurrence of the left-sided convulsions; the temperature promptly fell to normal and remained so; and the patient became partly conscious, with eyes no longer turned toward his right.

However, forty-eight hours after the first operation, my house-surgeon, Dr. Thomas, reported by telephone that the man had begun to have severe clonic convulsions of his entire *right* side (it will be remembered that he had at first right-sided convulsions, but to a far less degree than upon his left), and a resumption of Cheyne-Stokes breathing. Within an hour thereafter I visited him, finding the seizure apparently nearly as bad as that upon the opposite side had been. This was to me most puzzling; however, the indication as to my duty was a plain one.

Accordingly, the patient being again anæsthetized, the left Rolandic area of the skull was this time exposed and penetrated; but although considerable bone was removed with the Devilbiss rongeur, no blood clot was found; nor did the flat end of a probe passed between bone and dura at various points reveal any. Nevertheless the dura bulged into the bony gap, and without its normal pulsation. (I subsequently noted, in other cases, that the accumulation of blood in the limbs regularly puts a stop, almost or wholly, to the customary brain-pulsation observed, otherwise, in normal cases at operation.) Upon turning up a flap of dura we now exposed, lying beneath it—between it and the arachnoid and pia—an extensive, thick, partly organized clot, firmly adherent, covering an area as large as the parietal bone, and to all appearances being as old as the one removed from about the same level upon the opposite side two days earlier. It was removed in the same way—by blunt curette and irrigation. Plainly this clot was the main cause of his right hemiplegic convulsions. But no discoverable fracture—not even a crack—existed upon this left side. It must be clearly remembered, in studying this most rare case, that whereas the clot was *external* to the dura upon his right, it was *internal* to the dura upon his left. Unless this is explicable as an example of that condition, “contrecoup,” far more often written about than seen, the writer is unable to understand it. It seems probable that the extradural, basal bleeding re-started up at the first operation, as already chronicled, went on slowly beyond the point reached by the packing (which could only be extended to his left a little beyond the median line at the base); and spreading from below upwards, on his left, after the two days became—*plus* the large *subdural* clot—enough of a pressure-factor to have re-excited the right side convulsions, etc.

The recovery was ideal, and without incident. Three weeks later this patient was shown at a meeting of the Polyclinic Medical Society. At that time his faculties were entirely restored.

Regarding the bearing of these two operations on the special topic of this paper, all the staff noted with interest that, once under the anæsthetic, the patient slept quietly during the work upon both skull and clots, and only once or twice was a few drops more required. The first operation lasted fully an

hour; the second, about forty minutes. Also, it would seem probable that the accumulation of blood in the limbs aided clotting in contact with the gelatin-gauze, because of diminished blood-pressure at the bleeding point.

One deceptive sign in this patient—the temperature of 102° upon the twelfth day after the injury—is of interest. After barring out a rise of thermometer from infection of the superficial wound, should such be present—or from malaria, bronchitis, gastric catarrh, and from constipation—in a word, the usual causes, here remains a case requiring the opinion of an expert; and one of the neurologists to the hospital, Dr. Græme M. Hammond, expressed the opinion that the fever was due to pressure-irritation of the thermotaxic centre.*

A case of this kind is distinctly encouraging as showing once more that a class of accidents—hæmorrhage from fracture at the base, until recently not held operable—can sometimes be saved by active intervention.

CASE III.—*Trephining for Cerebral Cicatrix with Dural Adhesions.* This patient is a young gentleman, F. B. R., Jr., æt. 18, who has been afflicted since the age of seven, at which time he fell from a height, fracturing the right side of his skull. Operation was required, and performed by a certain New York surgeon. During all the years between seven and eighteen this boy has been subject at times to the most violent fits of temper, though ordinarily of a most gentle and tractable disposition. Latterly he has taken to drinking heavily, and has developed a periodic dipsomania. Upon examination of the skull two wide scars, each of about a finger's length, crescentric in shape, and

* Dr. Willy Meyer, in the discussion following the reading of this paper, reported a case of his own during the past year, exactly parallel as to fever, and hence as to reason for supposing the hemiplegia to be due to pressure from products of inflammation—fibrin, serum and pus. But operation proved that the febrile temperature was caused only by a large blood clot beneath the skull. At a recent meeting of the N. Y. C. Surgical Society Dr. Meyer has recorded yet another instance of such deceptive rise—the case proving at operation to be aseptic. However, absorption of fibrin-ferment from the clot, or other quite usual causes of such rise would seem to explain it without need of the assumption given in the text.

roughly parallel with each other, indicate the fields of operation consequent upon the fracture in his childhood. The parietal boss was about midway between these scars. Under each of these broad cicatrices it was believed that the meninges were adherent to the brain, as a consequence of the original infective inflammation: for there was a history of prolonged suppuration before these semicircular wounds healed. For the past two to three years there has been frequent twitching of the fingers on the left—the side opposite these scars. His mother says there is never an hour when they are quiet, except when they are controlled by his will. This indicates cortical irritation in the region of the hand-centre in the præcentral convolution. Operation was advised, to separate brain from an adherent dura mater, if nothing else should prove necessary. Consultation with Dr. Frederick Peterson resulted in receiving from him urgent advice to permit operation; not as definitely promising improvement, but as positively asserting a hopeless condition if operation should be refused. In other words, the knife was considered the lad's only chance, and a rather poor one at that.

Operation was performed by the writer in Dr. Bull's private hospital, December 6, 1905, assisted by Drs. John B. Walker, George F. Shiels, J. H. Waterman, A. L. Goldwater. Anæsthesia (ether) by Dr. Thomas Bennett. An incision was made to run midway between the two long and wide crescentic scars aforesaid and the skull was penetrated accordingly. With the Devilbiss rongeur an area of the dura as wide as the thumb was laid bare, and all these pieces were saved in warm, normal salt-solution. Just as anticipated, adhesions were found. In stripping these away from the brain the sound of the separation could be heard to the confines of the rather large room—an indication of their degree of firmness. It was at one time contemplated to prevent readhesions by leaving goldfoil or other smooth foreign material in place between brain and dura; but final reflection caused me to fear that even this might (upon this hypersensitive cortex) itself constitute, as a foreign body however smooth, a brain irritant. Instead, a thin layer of blood was allowed to form over this brain area and to clot firmly, before permitting the brain to come into relationship again with its dura. This was only possible by aid of the sequestration of blood in the limbs. Because of this the brain was found by no means fully filling its brain-case;

the stripping was accomplished with a dull tool curved to follow the brain contour; and one could see to work within the curve of the calvarium far beyond what would have been possible, and with far less risk of brain-laceration, than if a similar tool had been passed, guided only by sense of feel, between a congested, full brain and its skull.

The brain-work being ended, it was thought best to replace the pieces of skull. Since they were so small and of exactly equal size, each compared with all the others, nothing can be more ideal than the Devilbiss rongeur for encouraging such bone-replantation. Between thirty and thirty-five pieces were fitted together upon the dura, when this had first been sutured, where divided, with size double 0 of chromicized catgut. All of these pieces lived, being nourished by capillarity. It is obvious that the smaller the pieces of tissue of whatever sort which we attempt to engraft—whether of bone or ovary or thyroid gland or whatnot—the better its chance of surviving. For, its blood vessels being clotted, nothing but capillarity can carry to its interior the vitalized plasma which alone must nourish it.

In this instance we forgot to test the point noted in previous skull cases—whether anæsthesia once accomplished might not have been maintained by the brain anæmia due to the cordage. However, Dr. Bennett was asked to watch for any adverse signs consequent upon the accumulation of blood in both thighs and legs, and he reported that neither pulse nor respiration was affected in the least adversely. Duration of operation, one hour.

The patient had an ideal primary healing, his scar being practically invisible. As to results, from the time he awoke again until to-day he has had no return of the twitchings of his hand, and he volunteered the statement that his head feels better and clearer than for years. However, after a few weeks he went upon a violent spree; and after trying hypnotic suggestion with only temporary benefit, and the Oppenheimer "cure" with none at all, he has now been sent upon a sea voyage to South Africa in a sailing vessel with a temperance shipper and with no liquor aboard. It is, I fear, easy to prophesy the ending of this most pitiful case—an only son of fine parents. Perhaps, had the operation in question been performed sooner, before the dipsomania showed itself, removal of the adhesions as a persistent cause of brain irritability might have effected a real cure.

CASE IV.—*Trephining for Cerebral Cicatrix with Dural Adhesions.* Miss O'C., a patient of Dr. J. D. Quackenbos, æt. 27, is brought with the following history. Since the age of eleven she has been an epileptic. In that year while swinging in a "scup" she fell, striking her head with enough violence against the corner of a house to render her unconscious. Her attacks at first, though irregular in interval, as always, were a month or less apart. For the past year they have much increased in frequency, latterly the worst being at night, and averaging perhaps a fit in each 24 hours. Her mental powers, always rather poor since the accident, have noticeably deteriorated of late. The attacks begin by a feeling of dizziness; if there is a true aura of any kind the patient is unable to describe it. She drops unconscious, kicking and making swimming motions with her upper limbs. Both sides are alike as to their involvement in the attacks. Menses regular and not painful.

An examination of the shaven scalp revealed an old cicatrix about 4 cm. long, over a depression of the skull, of nearly that extent, and of about 1 cm. depth, situate about 2 cm. above and to her left of the inion. This is where she was struck, as a child. Although this case is of a type of epilepsy offering little hope indeed from operation, when compared with the results of surgical intervention where the type is Jacksonian, yet it seemed quite likely that there was irritation from the depressed bone beneath the scar; and in any case, operation was urged by Dr. Quackenbos as being her only chance of help. Accordingly this was done at the Polyclinic Hospital, before the class, upon April 10, 1906. By use of the DeVilbiss trephine and rongeur all the bone involved was removed. Although there had been some depression of the inner table, this was less than of the outer, the diploe having been crushed compact at this point; and there was no evidence of irritation beneath the bone, no thickening nor exceptional adhesion of the dura, nor (tested by the flat end of a probe through a tiny slit in the dura) was there any brain adhesion beneath. Obviously, little improvement could be hoped for in consequence of our work. Because of the depression the pieces of bone were not replaced; and to protect the dura over the rather large bony gap, it was decided to use the special kind of celluloid plate recommended by the writer at the St. Paul meeting of the American Medical Association a few years ago; a

kind carefully deprived of all free nitric acid, and with a trifle of synthetic urea replacing the usual irritant and abundant camphor, to give resiliency. Such a plate, transparent, resembling a yellow window pane, has several advantages, into which I cannot go here. In this instance, fifteen minutes was the longest period during which the cording enabled the anæsthetist to discontinue chloroform. Once more it was noticed how satisfactorily dry was the operative field.

This patient's recovery was per primam. At this time, some seven months after operation, her mother reports that the attacks are somewhat milder and less numerous than before operation. However, such temporary improvement, due apparently to the vigorous counter-irritation as much as anything, often results from mere penetration of the skull.

CASE V.—*Excision of Foot-Centre in Cortex for Relief of Jacksonian Epilepsy.* Mr. C. R., is a patient of Prof. Græme M. Hammond, in the City Hospital, New York, who refers him to me for operation. Age, 48; American; unmarried; occupation, driver; is a blond, fairly nourished but anæmic. Denies trauma, also venereal disease. Has had for seven years attacks of left-sided convulsions, at very irregular intervals of about two to three months, latterly rather more frequently, and coming on sometimes at night, which was not at first the case. Has long complained of headache over the right Rolandic area; no known cause for this. His attacks begin without aura, other than a severe dull headache for a half hour before an attack, the pain being in the right Rolandic region. Then comes twitching of the left great toe, spreading rapidly to foot, leg and thigh, to left side of body, arm, and finally to face; but he never loses consciousness. Great weakness of the muscles involved for some days afterwards.

Two years ago was operated upon by another surgeon, the scar being plainly visible. A large omega-shaped flap was then made and the skull opened accordingly. This was fully 6 cm. too far forward to expose the motor centre, and no good whatever was accomplished.

Upon December 17, 1906, I operated, in the presence of Profs. Hammond and George F. Shiels and Dr. Edwin Beer, and assisted by Dr. Wrenn, house surgeon, and the rest of the resident staff of the City Hospital. Dr. Dettweller, anæsthetist.

Dr. Shields kindly took charge of the sequestration-work. This patient had a severe degree of mitral insufficiency, not well compensated by hypertrophy. Chloroform was tried at first. Being badly tolerated, ether was substituted. Operation about two hours long, due chiefly to annoying oozing from the cut edges of the dura, which proved three to five times thicker than normal, over the area exposed (right Rolandic). This bleeding was trivial in amount, but of course had to be wholly controlled before closing the wound; also, the dural upper surface had to be dried before, with a naked copper wire and weak Faradaic current, the foot centre could be located. This being indicated approximately, the dural flap was cut accordingly; firm adhesions were found, binding the brain and leptomeninges to the thickened dura, and were separated with some little difficulty. Next, the precise situation of the foot-centre was ascertained upon the naked brain, and excised, cutting out the entire thickness of gray cortex over a superficial area of about $1\frac{1}{2}$ cm. square. This centre was found, as expected, to extend beyond the top and to include the adjacent mesial part of the lobule. Just as a matter of interest the arm and hand centres were also located by the electric current, lying entirely anterior to the fissure, and between the centres governing the face and the trunk-muscles. To prevent re-adhesion a thin sheet of gutta-percha tissue was laid smoothly in place over the brain, covering the whole area exposed, and then the dura mater was sutured.* To allow relief from pressure upon the cortex by the thick dura, the skull was not replaced, but instead a slightly dome-shaped piece of the special celluloid mentioned in Case IV was inserted. This was of but half the entire thickness of the calvarium in this region, yet was very strong, rigid and smooth. It rested upon a narrow ledge of the vitreous table, the outer one having been chiselled away a trifle for this purpose.

Regarding the result of sequestration in this case, it was very unsatisfactory because of the man's heart disease. For several periods, of about seven minutes each, anæsthesia was withheld, but then had to be resumed. Probably without sequestration the same could have been done. As soon as the limbs became

* Prof. Hammond has seen the skull re-opened five years after such a gutta-percha tissue layer had been used, and states that it was found very full of holes; and evidently before much longer would have quite disappeared by absorption.

distinctly swollen the heart-beats mounted quickly to 130 or so, at which point, upon uncording, they dropped speedily to about 80. This was tried a second time, for purposes of study. Of course this operation was no fair test of sequestration; and this, too, was the reason of the long delay in checking the oozing from the dura. Were the blood not so actively flowing, the steaming gauze would have sealed the vessel-mouths promptly. Given an example of uncompensated valvular disease, we plainly have one of the instances—to be discussed later—where this operative aid (sequestration) is counterindicated.

Healing was by primary union throughout, in this patient's case, and without incident. As to the results of the foot-centre excision upon his epilepsy, Prof. Hammond's detailed report is not given herewith because it has no bearing upon surgical technique; but he expresses himself as well satisfied, and hopeful of a cure, so far as the interval of time since operation permits him to judge.

CASE VI (and last, making seven head-operations by the method under discussion).—*Excision of Hand-Centre in Cortex for Relief of Jacksonian Epilepsy.* Mr. D. E., is a patient of Prof. Græme M. Hammond, in the City Hospital, New York, who refers him to me for operation. Age, 20; American; no occupation; single; denies venereal. He is short, dark, well-nourished, stupid in expression. At the age of four met with an accident, falling a short distance (unknown), striking upon his head. Doubtful whether this is important, for the convulsions began only at the age of nine. No other ascertainable cause. These occur from once to several times daily. They begin without aura, by twitching of the flexors of the left hand, spreading quickly up that arm and into the same side of the face. He is never unconscious because of them, but feels exhausted afterwards. His left hand and arm are distinctly smaller and weaker than his right; the hand-clasp about half that of the right. The left hand is always the colder also. He can use simple language coherently, but voluntarily mentions a failing memory; always poor but much worse of late. Is anxious for the operation advised by Prof. Hammond—though that gentleman has but slight hope of its effectiveness in this case.

Operation in the City Hospital December 31, 1906. Present: Prof. Hammond, and resident staff; Dr. Wrenn, house surgeon;

Dr. Dettweller, anæsthetist. Chloroform anæsthesia, under which the operation was begun; but it was discontinued, and thereafter (forty-five minutes) work continued, including exposure and cutting of dura, and its final suturing, with only the analgesia due to the sequestration, and without any restlessness or other indication of suffering.

The Rolandic area upon his right was marked out, an omega-shaped flap, including the bone, was lifted by aid of the Devilbiss rongeur, and attempts made to locate the hand-centre through the dura by the copper wire and very weak Faradaic current. So irritable was the entire motor area of his cortex, however, that wherever touched with the wire all the muscles of the opposite side responded. However, after some minutes of this testing, and doubtless excited by it, a convulsion occurred, lasting a few minutes, and exhausting thereby the excessive irritability; so that upon its cessation we were able without difficulty to locate the hand-centre, causing no twitching in muscles elsewhere. The dura being turned up, the centre was more accurately marked, and excised, taking out a square piece of the gray, down into the white, the entire transverse width of the præcentral lobule; in dimensions about as in the previous case.

Nothing abnormal was noted at operation either in appearance of bone, dura, leptomeninges, or brain, in this patient. However, by microscope, the pathologist reports evidences, in the piece of cortex excised, of chronic abnormality in cellular arrangement. Details omitted as having no bearing upon surgery.

There remains one point of exceptional interest. During the cutting of the skull by the Devilbiss rongeur, along the terminal 4 cm. of this omega curve, the blade, which, travelling beneath the skull, should never penetrate the dura—and never has before, to my knowledge—in some way slipped through, and for this distance ploughed the brain-cortex. This caused bleeding, welling up from the cerebrum at points not possible of exact location. I did not wish to pack, neither to apply chemicals—other than adrenalin solution upon a narrow gauze strip tucked gently down into the brain tear—which, however, did not stop the flow at all. Finally, remembering that boiling water had not harmed the pneumogastric nerve in the case operated upon at Dr. Wyeth's clinic (see footnote earlier in this paper), I tried gauze wrung out of water at 212° F. and tucked down into the tear, as before.

This succeeded after several repetitions of a few seconds each. It apparently did no harm to the brain tissue, so far as the recovery is a guide. A narrow strip of gutta percha tissue, to prevent adhesion of the brain to the dura at this point, was smoothly laid down, and the dura was sutured above it. The bone-flap was replaced. After the dura was sewn the cording was released, taking five minutes; and now, after three-quarters of an hour without chloroform and without pain, the patient began to wake up. Healing was by primary adhesion, with no unpleasant features whatever.

This case is too recent to permit of decision as to whether the operation is going to be of permanent benefit to his epilepsy or not.

If we now discuss the counterindications to this, which for convenience has been called sequestration surgery, it will at once be seen that they are quite numerous, and that a reasonable degree of common sense must be employed in determining when to use and when to avoid it. Like every weapon in our armamentarium capable of good, it is also capable of harm, if turned against a patient by a surgeon gifted in that way. Let us study these points, concerning which I have much to thank my friend Dr. Boise, of Grand Rapids. His article upon "Post Operative Embolism" is an equally clear study of ante-operative thrombosis; or again, of the causes which during sequestration would operate to produce clotting of the comparatively quiescent blood. To study these in an orderly way, one may say that there are three: (*a*) changes in the blood, (*b*) changes in the vessel walls, and (*c*) changes in speed of current. The last would be unimportant without one or both of the first two named; for normal blood will not at all readily coagulate when held even without motion within normal blood-vessels, and in our technique a moderate degree of circulation is maintained throughout. In Bier's method of treating joint inflammation often the partial stasis by cording is kept up for a half day at a time, and, though hundreds of cases have been reported, so far without dangerous result. But given either unhealthy blood or blood vessels as a predisposing cause,

slowing the current would then act as an exciting one, and make sequestration dangerous from venous thrombosis and possibly subsequent pulmonary embolism.

To specify several blood-conditions of serious import, we name the following: Recent typhoid, or any other septic condition of the blood, such as puerperal sepsis not long past; chlorosis, and indeed severe anæmia of any sort; and the presence of lime-salts in excess. Haward* shows that the blood of typhoid convalescents is much more coagulable than normal, and that it contains twice as much lime salts; and implies that its increased coagulability is due to this last fact. Obviously, since increase of these salts invites clotting, and indeed since we use this knowledge in preparing patients for certain operations where there is likely to be troublesome bleeding, we must recollect not to do so if intending to employ sequestration.

As to diseases of the vessel walls, atheroma is an obvious counterindication. Of course yet others exist which we cannot stop to study at this time.

As tending to prevent thrombosis, it is interesting and soothing to remember that prolonged smoking markedly has this good effect. B. M. Richardson showed by experiment that after a long day's smoking the blood refused to coagulate at all, where in the same patient, blood drawn in the morning had clotted in two minutes.†

Accepting Horsley's assertion, quoted earlier in this paper, it follows that the duskiness of the limb—the cyanotic or venous character of the blood held within it—would rather tend to prevent clotting; at least he strongly recommends arterializing the blood by oxygen, when very dark in color, as a means of causing coagulation when bleeding would otherwise continue. And yet Haward (*loc. cit.*) names carbonic dioxide among a list tending to *increase* coagulability of the blood, and oxygen as *decreasing* the tendency to clotting.

* Hunterian lecture, *Lancet*, March 10 and 17, 1906.

† *The Cause of Coagulation of the Blood*, p. 101 (quoted by Haward, *loc. cit.*).

Plainly there is a contradiction here; and either Haward or Horsley is incorrect in his deductions.

In conclusion, the following are the chief advantages of the method by sequestration in brain work of certain kinds:

(1) A diminution in amount of anæsthetic needed, with consequent relative safeguard against bleeding due to straining from subsequent vomiting, and against hernia cerebri; also against lowering of vital heat.

This operative analgesia is only obtainable with limbs well swollen and dusky. It is not always accomplished; but assuredly is in certain patients, the number studied as yet not being large enough for us to reach percentage conclusions.

(2) Ease of control of hæmorrhage during operation because of lessened intravascular tension.

(3) A shortened operation because of a dryer field.

(4) Through lowered intracranial pressure consequent upon accumulation of blood elsewhere, there is lessened danger of sudden death from pressure upon the respiratory centre during work upon brain-tumor, or upon depressed fractures, etc.; and, too, just in proportion as there is bleeding, whether external or into the limbs, there is increased depth and frequency of breathing.

(5) More space between brain and brain-case, enabling the operator to work between, in removing old clots requiring curettage, or the separation of adhesions, etc., without risk of laceration of the brain surface.

PAPILLARY-CYSTADENOMATA OF THE BREAST.

A REPORT ON TWENTY CASES OF THE PAPILLARY CYSTADENOMA TYPE OF
FIBRO-EPITHELIAL TUMORS OF THE BREAST.*

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IN the Oration in Surgery delivered by Dr. J. Collins Warren at the meeting of the American Medical Association at Portland, Oregon, in July, 1905, a classification of benign breast tumors was presented which was based upon the study of 758 consecutive cases collected and analyzed by the writers of this communication. This classification was offered in the hope that the existing confusion in the nomenclature of tumors of the breast might be done away with.

The difficult point in the classification of benign breast tumors is the association of connective tissue and epithelium in their composition. The breast is a gland structure of epithelial lined ducts supported in a stroma of connective tissue. All tumors having origin in the breast tissue show a participation of both of these elements in varying proportion. In one case perhaps the fibrous tissue predominates, in another the epithelial, but an authentic case of a tumor composed solely of either fibrous tissue or epithelium has not yet been described. It is because of the attempts of different pathologists and clinicians to apply to the tumors of the breast the names accepted for tumors of other organs that such hopeless con-

* Read at a meeting of "The Obstetrical Society of Boston," Nov. 27, 1906.

fusion has resulted, and it was not until Ribbert in his classification of tumors offered a special group of mixed or "fibro-epithelial" tumors that this confusion began to pass away. Ribbert's classification, however, is purely pathological and does not lend itself to the description of the different forms of tumors of the breast as they appear in surgical practice, and the purpose of Dr. Warren's classification is to harmonize the clinical signs and symptoms of these tumors with their pathological nomenclature.

The first, and perhaps most important, distinction made by Dr. Warren's classification is the separation from the group of tumors of the diffuse processes, giving to the latter the names of (*a*) diffuse hypertrophy and (*b*) abnormal involution. Cases of diffuse hypertrophy have sometimes been confounded with tumors of the periductal fibroma type, and abnormal involution, or cystic disease, has been regarded by many writers as a peculiar form of a new growth, and has been called cystadenoma. Because of its diffuse character, however, this disease cannot properly be regarded as a tumor, although the epithelium shows a tendency to proliferation which in certain respects closely resembles a neoplastic process. The lack of encapsulation, however, and the participation in the process of the whole breast and often of the breast of the other side, seems to warrant its removal from the category of true new growths.

The fibro-epithelial tumors of Ribbert have been divided by Dr. Warren into two groups—the fibrous and the epithelial types (see Table I).

TABLE I.

CLASSIFICATION OF BENIGN BREAST TUMORS. (WARREN.)

I. Fibro-epithelial tumors:

- | | |
|-----------------------------------|--|
| (A) Fibrous type | $\left\{ \begin{array}{l} 1. \text{ Periductal fibroma.} \\ 2. \text{ Periductal myxoma.} \\ 3. \text{ Periductal sarcoma.} \end{array} \right.$ |
| (B) Epithelial type (Cystadenoma) | |
| | |

II. Hyperplasia:

- (A) Diffuse hypertrophy.
 (B) Abnormal involution (cystic disease).

Tumors of the fibrous type in which the fibrous tissue predominates have been called periductal fibroma, periductal myxoma, or periductal sarcoma. They are tumors arising from the peculiar hyaline periductal fibrous tissue of the breast, and they are made up for the most part of this fibrous tissue, although they contain portions of the epithelial gland substance in the form of much distorted ducts and clefts lined with epithelium. The bulk of the tumor is made up of fibrous tissue and it is classified as periductal fibroma, periductal myxoma, or periductal sarcoma, according to the degree of cellular development and richness in nuclei of this tissue. In these tumors it is obvious that the epithelium participates in the growth only as it is secondarily involved by the increase in amount of the fibrous tissue. They are the firmly encapsulated tumors found in the breasts of young women, may be single or multiple, are freely movable in the breast substance and have passed under a variety of names, such as, fibro-adenoma, chronic mammary tumor, proliferous cyst, adenocoele, cystosarcoma phylloides, intracanalicular papillary fibroma, etc.

The epithelial type of fibro-epithelial tumors are those in which the epithelial new growth overshadows the growth of fibrous tissue. In these tumors fibrous tissue is present merely as a stroma to support the epithelial new formation. Tumors of this type, or cystadenomata, are divided into two main classes—fibro-cystadenoma and papillary cystadenoma. The first class, the fibro-cystadenomata, are localized tumors of periductal fibroma origin, in which epithelial proliferation or cyst formation has progressed to such an extent as to overshadow the growth of fibrous tissue. These tumors have been described in the past as cystic fibroma or cystic fibro-adenoma. They are comparatively rare and are of little importance as compared to those of the second group.

Papillary cystadenomata are not uncommon. They are localized tumors—either single or multiple—and involve, as a rule, the large ducts of the breast. They consist of one or more cysts partially filled with papillary outgrowths, arising from

the wall. The papillary growths have a vascular branching connective tissue stalk supporting a luxuriant growth of epithelium in the form of villous projections and gland-like interlacing tubules and canals. The epithelium shows no tendency to infiltrate the surrounding tissues. Tumors of this class have been recognized and described by many writers and under many names: adenoma, villous papilloma, duct papilloma, duct cancer, cystadenoma intracaniculare, carcinoma villeux, endocanicular papillary fibroma, etc.

The material upon which this report is based consists of twenty cases of papillary cystadenoma. The specimens were obtained from private practice and at the Massachusetts General Hospital in the services of the following surgeons: Dr. J. C. Warren, Dr. A. T. Cabot, Dr. H. H. A. Beach, Dr. C. B. Porter, Dr. M. H. Richardson, Dr. J. W. Elliot, Dr. W. M. Conant, Dr. S. J. Mixter, Dr. F. G. Balch, Dr. R. B. Greenough, Dr. C. A. Porter, and Dr. C. L. Scudder, to all of whom the writers would here express their thanks for the privilege of reporting the cases. Much of the pathological material was placed at our disposal by Drs. W. F. Whitney and J. H. Wright, to whom we would also express our gratitude.

Of the twenty cases of papillary cystadenoma three showed the presence of adenocarcinoma. In the other seventeen cases no evidence of malignant disease was to be obtained. A gross and microscopic examination was made of the specimen in nineteen of the twenty cases; in seventeen cases the microscopic specimens and in many cases the gross specimens also were available for re-examination.

The gross appearances of the seventeen specimens of simple papillary cystadenoma showed the following characteristics: A palpable tumor was present in the breast substance in every case. In twelve instances the tumor was single. In five a number of different nodules were present, forming a conglomerate mass. The tumors varied from the size of a pea to that of an orange. Their situation was almost invariably in the central portion of the breast close to or under the nipple, although the larger cysts extended outward and occasionally

occupied almost the entire substance of the gland. In cross section these tumors presented one or more cysts of varying size containing fluid, which was usually bloody, and filled to a greater or less extent by papillary outgrowths from the wall. The cysts were as a rule well marked off from the surrounding breast tissue and were not adherent to the skin, although in six cases the skin appeared to be closely applied over the tumor and was not freely movable, a fact which was attributable rather to the size of the cyst and its position near the nipple than to any infiltration of the tissue. Retraction of the nipple was noted in the record in three of the seventeen cases of simple papillary tumor and in two of the three cases of adenocarcinoma. It is possible that the development of a benign tumor in the large ducts acts in somewhat the same way as the development of cancer to cause a drag upon the ducts and retraction of the nipple.

The axillary glands were enlarged in only two cases. They did not show malignant involvement even in the cases of carcinoma.

Microscopic sections of the tumors showed one or more cysts. The cysts were as a rule well marked off by a definite layer of fibrous tissue from the surrounding substance of the breast. The breast tissue usually showed evidence of compression by an increase of its fibrous tissue, and occasionally the presence of a small amount of round-cell infiltration. In some cases involution changes were present in the surrounding tissue, which is not surprising when we consider the age of the patients under consideration.

The walls of the cysts were lined with flattened or columnar epithelium which was apparently derived from the larger ducts (Figs. 1 to 6). In one specimen of a tumor of this nature, not in this series, a fortunate section revealed a continuous line of epithelium from the nipple to the wall of the cyst cavity.

The most characteristic feature was the presence of papillary outgrowths from the cyst wall. These papillary growths were composed of a fibrous tissue stroma, with many blood vessels, supporting one or more layers of epithelium continuous

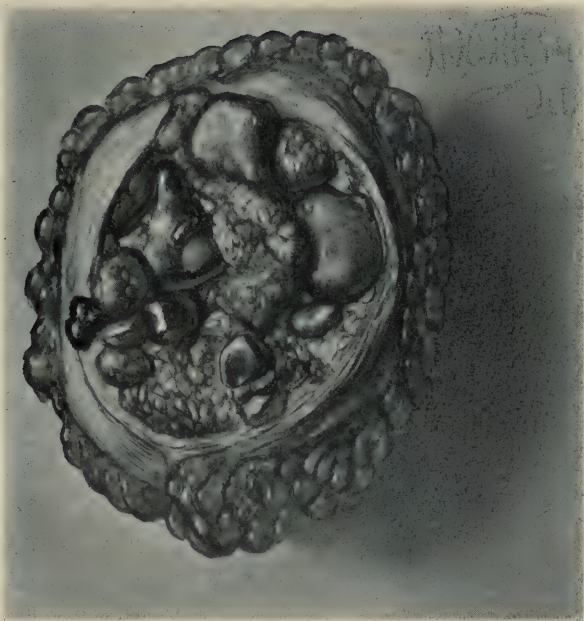


FIG. 1.—Papillary cystadenoma' from a girl of 19, removed by an areolar incision. The specimen consisted of a cyst cavity situated directly under the nipple and filled with papillary ingrowths. These varied greatly in size, shape, consistency and color, and the whole could be aptly compared to a gall-bladder full of stones. The color and shape of these ingrowths was due to oedema, hæmorrhage and necrosis.

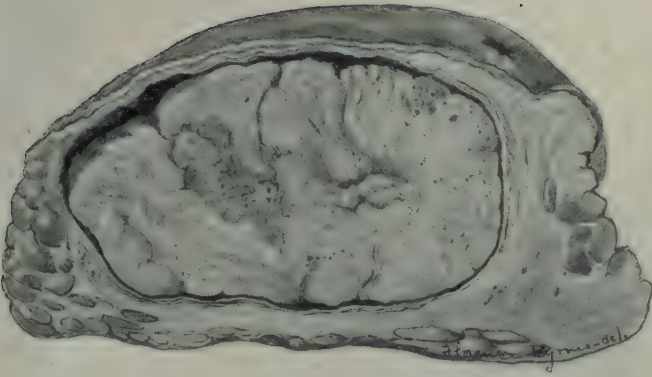


FIG. 2.—Papillary cystadenoma. The cyst was of four years' duration and occurred in a woman 43 years old. It illustrates well the single large type of cyst, the size being due not to the rapid growth but to the long duration. There was a small fistulous opening through the skin. The cyst contained a papillary mass of grayish white friable tissue, which on section was composed of distorted glands and fine fibrous stalks largely necrotic.



FIG. 3.—Papillary cystadenoma. Section showing the cyst wall and papillary ingrowth. The cyst was lined by a layer of flattened epithelium. The fibrous tissue around this was dense and infiltrated with round cells. The gland ducts in the vicinity were flattened and mechanically disturbed, but otherwise showed little change. The papillary growth completely filled the cyst, which was 2 cm. in diameter. It apparently had several attachments, one of which is seen to the left of the photograph, although this evidently is not the chief one. The appearance of the glands and fibrous tissue is well shown. The dark areas in the papillary growth, (suggesting artifacts) are vessels filled with blood. On the right of the drawing (where the glands are not as numerous) the fibrous tissue is œdematous.

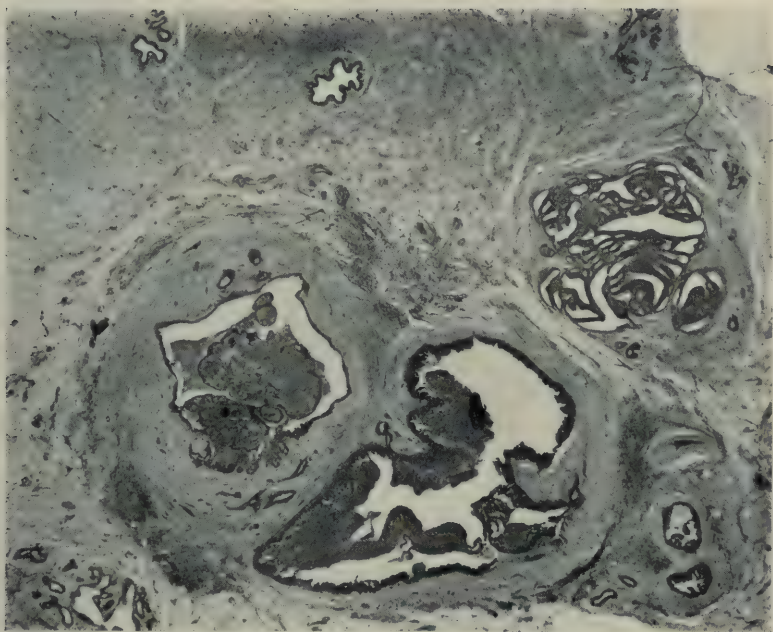


FIG. 4.—Papillary cystadenoma. Small multiple type. These tumors were situated under the nipple and occupied the larger ducts. They were all small, the largest being but $\frac{1}{8}$ cm. in diameter. The papillary projections in the one to the right of the photograph are formed of delicate branching stalks of fibrous tissue covered with epithelium, the whole forming an irregular mass of somewhat atypical gland ducts. In the cyst in the center of the specimen the epithelial proliferation has been so great as to mask the fibrous tissue, while in that in the left, the fibrous tissue is abundant, somewhat necrotic and œdematous. There is a large amount of interstitial fibrous tissue surrounding the cysts.



FIG. 5.—Papillary cystadenoma with adenocarcinoma. The upper photograph shows the cyst cavity to the left and the adenocarcinoma (the dense white area) on the right.

In the lower photograph the cyst cavity is seen to the right of the nipple partially filled with papillary ingrowth from the base of which the adenocarcinoma has developed. This is almost directly under the retracted nipple and is adherent to the skin.

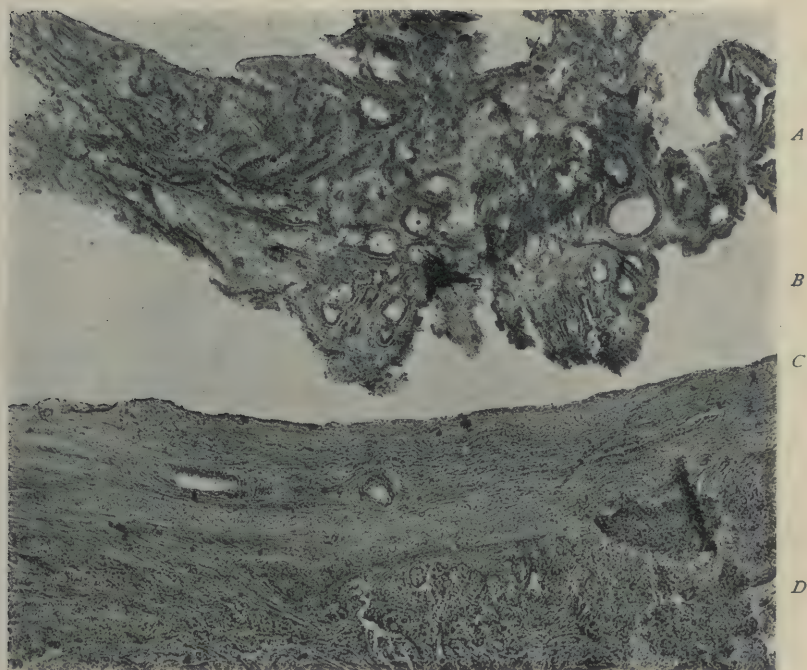


FIG. 6.—Papillary cystadenoma and adenocarcinoma. Section through the wall of a papillary cystadenoma. The cyst was situated under the nipple and was 2 cm. in diameter. It was filled with bloody fluid and contained a friable papillary ingrowth. Microscopically at the base of the papillary growth the surrounding tissue was infiltrated by the atypical glands characteristic of adenocarcinoma.

- A*, Papillary ingrowth.
- B*, Cyst cavity.
- C*, Cyst wall.
- D*, Adenocarcinoma.

with the lining of the cyst. The papillary masses were often divided into many branches and occasionally interlaced in such a way as to present the appearance of a multitude of gland tubules and ducts, lying in a fibrous stroma. The papillæ were often attached to the cyst wall at several points in their circumference. Degenerations of the connective tissue, hæmorrhagic areas and areas of œdema were not uncommon.

The epithelium appeared in many different forms. The lining of the larger cysts was commonly flattened and of several layers. That of the smaller cysts was higher and that covering the papillary outgrowths was often columnar and of different degrees of size and development varying from the familiar narrow cells of the normal ducts, to the high, columnar, well-formed cells seen in the adenomatous proliferation of abnormal involution. So far as anatomical and histological data were available, the origin of the papillary cystadenomata was in the fibrous tissue and epithelium of the walls of the larger ducts.

The degree of proliferation of the epithelium varied in different specimens and even in different portions of the same microscopic section. In one place several layers of flattened cells were found, while in others a single layer of high columnar cells alone was situated against the basement membrane.

The rate of growth of these tumors is very slow, and, as might be expected, the epithelium showed but little evidence of rapid reproduction; mitoses were occasionally seen but were comparatively rare. Degenerative processes in the papillary masses were not uncommon, and in one specimen particularly, a hyaline degeneration was observed which produced homogeneous masses of varying color from red to green and black, which resembled gall-stones closely as the papillary growths lay in the opened cyst.

The cyst cavity, in addition to the polypoid tumor masses, contained serous or sanguinolent fluid, apparently from thrombosis or rupture of the vessels of the villous stalks, and in some specimens the wall of the cyst was deeply stained with blood pigment of similar origin.

With regard to the etiology of tumors of this type, very

little can be said. Trauma was cited by the patient as the supposed cause of the tumor in five cases. In eight cases no history of trauma could be obtained, and in seven no data on this point were available. So far as age is concerned, the papillary cystadenoma is generally a tumor of old age. The average age of twenty patients was 49.5 years. The extremes, however, cover a large period—the youngest patient being 19 years old and the oldest 81. It is to be noted that no gross or microscopic peculiarities were found to differentiate the tumors of young women from those of older years. The influence of marriage and lactation does not appear to be significant. One of the twenty cases was a male patient of 51 years of age. Of the nineteen women, eleven were married and eight had had children. Thus of nineteen cases of papillary tumors there were eight in women whose breasts had undergone lactation, and eleven in those which had not. Whether in development the polypoid outgrowths from the wall of the duct produce the cyst, or whether the cyst is first produced, and the papillary outgrowth is a secondary process, can only be a matter of speculation.

The symptoms of papillary cystadenoma are perhaps more characteristic and better defined than those of the majority of tumors of the breast. One or more nodules are found in the central portion of the breast, not far removed from the region of the nipple. These nodules may vary from the size of a pea to that of an orange or larger. They are generally described as hard in consistency, but if not too deep in the breast tissue, and if of sufficient size, an elastic or cystic feeling may be appreciable. One tumor was described as soft, and in a number of cases no tumor at all was felt until some time after the recognition of the bloody discharge from the nipple. The size of the tumors varied in certain of the cases, according to the amount of fluid contained, and could be diminished at will by pressure, forcing the fluid out through the nipple. Pain was present in about one-half of the cases, but was rarely severe, and was not a conspicuous symptom of these tumors, in distinction to the more painful character of abnormal involution.

The symptom which is of the greatest value in the differentiation of papillary from other tumors of the breast is the existence of a serous or bloody discharge from the nipple. This discharge was present in eleven of the twenty cases, while in four of the others the record failed to give information upon the point. It is not to be expected that discharge will always be present, as the escape of the fluid must depend on the patency of the duct between the cyst and the outer world. In one case a fistulous opening was established from the cyst through a sinus which opened at the edge of the areola, but such a condition is obviously rare.

Tumors of this type are of slow growth. The average duration of the tumor before operation was 25.8 months, the longest being eight years and the shortest one month. It is significant, however, that in three cases at least the discharge from the nipple was present for a long time prior to the discovery of the tumor.

Enlargement of the axillary glands to such an extent as to make them readily palpable is not to be expected. In two of the twenty cases the records state that enlarged glands were felt in the axilla. In the remaining eighteen, including the three cases of carcinoma, no enlarged glands were felt. It is well known that in thin persons, and as a result of irritation, enlargement of the axillary glands sufficient to make them readily palpable is not uncommon. In cases of abnormal involution this frequently occurs. The presence of slightly enlarged glands, however, is of little significance in diagnosis.

The diagnosis of tumors of this character from other tumors of the breast is facilitated by three chief symptoms—*i.e.*, the situation, under or close to the nipple; the slow, painless growth; and the presence of a discharge from the nipple of bloody fluid. As accessory symptoms it should be noted that the skin is not adherent, nor are the axillary glands enlarged.

The conditions with which these tumors are most likely to be confounded are cancer, abnormal involution and periductal tumors. From cancer they are distinguished by their

slow growth, definite outline, and by the freedom of skin, muscles, and axillary glands from involvement in the disease. Discharge from the nipple in cancer is very rare.

From abnormal involution the diagnosis is more difficult. Serous discharge from the nipple in such cases is occasionally noted. The diffuse character of this condition, however, and the irregular nodular consistency of the breasts associated with pain and tenderness are points that aid in differentiation. Involution changes also are more common in the periphery of the breast, while papillary tumors occur almost invariably near the nipple.

From periductal fibromata, the diagnosis should not be difficult. The periductal tumors occur, as a rule, at a much younger age. They are firm and elastic, often of large size, and rarely occur near the nipple. They slip and slide in the breast tissue, and never produce discharge. The periductal fibromata are far more likely to be confused with the fibrocystadenomata (the other type of the cystadenoma or epithelial group), and it is doubtful if the two can be distinguished without the aid of the gross and microscopic examination.

The prognosis of a papillary cystadenoma is uncertain. They are tumors of slow growth and may exist for years without producing serious inconvenience. By the English writers, tumors of this type have been described which in time protruded from the nipple as granular and bleeding polypi. This did not occur in any of these cases. Enlargement to such a size as to cause serious disfigurement did not occur, although one tumor as large as an orange was produced, and a fistulous opening leading to the cyst was already established when the case came under observation. There was no obvious suppuration, but it is to be supposed that infection might readily occur and be followed by necrosis and sloughing of the tumor.

As in all of the tumors of the adult breast, the chief point of interest in prognosis is the likelihood of cancer. In this series of twenty cases, cancer was present in three instances and appeared to be associated with the existence of the papillary tumor, that is, the cancerous nodule was in the wall of the

cyst, and the type of growth, adenocarcinoma, was the same in all three cases. Except for the infiltration of the surrounding tissues, the cancerous nodules presented characteristics of growth of the same general character as the papillary structures within the cyst, although the irregular cell growth and infiltration left no doubt about the diagnosis of adenocarcinoma. The occurrence of cancer, however, in fifteen per cent. of the cases of papillary cystadenoma is sufficient to warrant the early and complete removal of these tumors, and to justify their classification in a group apart from the periductal type of fibro-epithelial tumors which show no such predisposition to the occurrence of malignant disease.

The duration of the three cancer cases was 9, 12 and 18 months respectively, and their ages were 52, 69 and 76 years. Several of the cases which showed no evidence of malignant disease had been in existence for much longer periods, and in women of equally advanced years. It is perhaps worthy of note that none of the cancer cases showed the familiar symptom of discharge from the nipple, whereas it was present in all of the non-malignant tumors of more than eight months' duration of which we have specific notes. The occurrence of cancer in tumors of this character has been noted by many writers. It is undoubtedly this tendency which has led the English writers to the indiscriminate use of the word "duct-cancer" for papillary tumors of this kind. Tietze and Sasse have each described cases of this character, under the names of cystadenoma proliferum destruens malignum (Sasse) and adenocarcinoma destruens (Tietze). That a form of adenocarcinoma occurs in certain cases of papillary cystadenoma is supported by this series of cases, but that this is sharply to be differentiated from other forms of adenocarcinoma is perhaps open to question. Of the three cancer cases, two showed no evidence of recurrence at one and two years after amputation of the breast; the third case died of recurrence four years after operation. In only two cases, however, was the axilla dissected, and in these no diseased glands were found. In none of the three cases were the axillary glands palpably enlarged.

From the consideration of the course of development of papillary tumors of the breast it is obvious that radical removal of the tumor is to be advised. As in all other cases of breast tumor also, the frequency of the occurrence of cancer makes an exploratory operation the duty of the surgeon in every case of tumor in which the diagnosis cannot positively be determined to be benign and free from danger of subsequent malignancy; and the number of such cases, with the exception of the small multiple periductal fibromata, is almost nil. When the tumors are large, or multiple, amputation may be necessary to obtain complete removal; but when small and single the breast should certainly be saved. Excision may be performed from the under side of the breast by the "plastic resection" operation advised by Dr. Warren and described in the *Journal of the American Medical Association*, July 15, 1906. In some cases, however, the operation may be simplified, and a small tumor under the nipple readily removed by an incision which follows the lower border of the areola for a quarter or third of its circumference. This incision is carried through the skin alone. With retractors the wound is then drawn open in a direction radiating from the nipple, and the subsequent dissection for the removal of the tumor is carried on by radial incisions in order to avoid injury to the other ducts than the one involved in the tumor. This incision does very little damage to the breast and leaves a scar which is scarcely discernible after a month or two has elapsed.

If microscopic or gross examination of the specimen reveals the presence of carcinoma, it is obvious that a complete operation should be performed. In such a case the pectoral muscles and the axillary contents should be removed, for, although the type of cancer is of relatively low malignancy, the complete operation is only a reasonable precaution. When this is done, the prognosis should be far more favorable than in the average case of cancer of the breast.

Of the seventeen cases of non-malignant tumor in this series, seven had an amputation of the breast, eight had the tumor excised by a plastic or direct incision, and two by the

areola incision. In one of the amputation cases the axilla was also dissected. The results of these operations were as follows:

Of the seven amputation cases, one patient could not be traced, five were free from disease at periods of one, one and a half, two, three and eight years after operation, and one died of old age and debility three years after operation without recurrence.

Of the ten excisions, three were untraced, one showed a local recurrence of the tumor after six months, which has persisted for three and a half years without further increase; another showed a local recurrence eighteen months after operation, which was removed, and the patient has not since reported. The other five cases were examined or reported free from disease at periods of one and a half, three, six, and eighteen months, and four years after operation. Of the two cases of recurrence, one was proved by microscopic examination to be similar to the original tumor and non-malignant, and the other had existed without change for three and a half years, so that the presumption is fair that complete removal of the original tumor was not obtained at the first excision. It is obvious that this should be done in every case, even if amputation is required; but we believe that so radical a procedure is rarely needed.

SUMMARY.

Twenty breast tumors of the papillary cystadenoma type showed the following characteristics:

(1) They were single or multiple, involving the large ducts near the nipple, and composed of one or more cyst cavities from the walls of which grew papillary outgrowths composed of a fibrous tissue stroma and a luxuriant growth of duct epithelium in the form of irregular gland tubules and polypoid projections.

(2) Tumors of this character have been described by many names, viz. adenoma, duct papilloma, duct cancer, villous papilloma, cystadenoma intracanalicular, proliferous cysts, etc.

- (3) They occur in the male breast as well as in the female.
- (4) They occur at all adult ages and independent of trauma, marriage or lactation.
- (5) They are usually painless.
- (6) They are generally situated near to or beneath the nipple.
- (7) They are usually of small size, but occasionally attain the dimensions of an orange.
- (8) They are of slow growth.
- (9) Their most characteristic symptom is the presence of a discharge from the nipple which may be serous, but is usually bloody in character.
- (10) Do not cause enlargement of the axillary glands.
- (11) Fifteen per cent. of the twenty cases in this series were associated with a form of cancer (adenocarcinoma) of a relatively low type of malignancy.
- (12) Treatment demands the complete removal of the tumor, either by excision or, if necessary, amputation of the breast.
- (13) Excision may be performed by plastic resection or by an areola incision.
- (14) The association of cancer with papillary cystadenoma in fifteen per cent. of the cases justifies the separation of this group from other fibro-epithelial tumors of the breast in clinical and pathological classification.

ABSTRACT OF CASES.

I. No. 123. 1896. Dr. J. W. Elliot (ix-180). Female, 57. Married, 1 child. 2 months' duration. Tumor, size of walnut. Right breast. Upper outer quadrant, no pain; discharge not recorded. Excised. Recurrence 2 years later. Same situation. Size of hen's egg. Excised. Both papillary cystadenoma. No later report.

II. No. 11. 1896. Dr. J. C. Warren (320-44). Female, 44. Single. 6 years' duration. Tumor, 2 inches in diameter. Left breast. Upper half. Pain slight. Discharge from nipple for 10 years. Excised. Papillary cystadenoma. No later report.

III. No. 65. 1897. Dr. H. H. A. Beach (325-211). Female, 52. Married, 1 child. 11 years' duration. Tumor, 3 inches in diameter, under nipple. No pain. Discharge not recorded. Excised. Papillary cystadenoma. No further report.

IV. No. 15. 1895. Dr. A. T. Cabot (334-70). Female, 61. Single. 9 months' duration. Tumor, size of orange. Left breast, under nipple. No pain. Discharge not recorded. Amputation. Papillary cystadenoma. 1906, reports no further trouble.

V. No. 91. 1900. Dr. H. H. A. Beach (339-2). Female, 57. Widow. 2 miscarriages. 1 months' duration. Tumor, size of hazel nut, under nipple. Pain slight. Discharge serous for 10 years. Bloody in last 12 months. Excision. Papillary cystadenoma. No later report.

VI. No. 217. 1901. Dr. J. C. Warren. Female, 81, single. Tumor, size 3 cm., near nipple. Slight pain. No discharge. Amputation. Papillary cystadenoma. Died $3\frac{1}{2}$ years later of old age and debility. No trouble with breast.

VII. No. 166. 1902. Dr. A. T. Cabot (11-220). Female, 42. Married. 6 children, 1 miscarriage. Normal lactation. $1\frac{1}{2}$ years duration. Tumor size almond, under nipple. Slight pain. Discharge brownish and bloody for 3 years. Excision. Papillary cystadenoma. Tumor recurred in same situation and has persisted for 4 years. No further operation.

VIII. No. 171. 1902. Dr. W. M. Conant (lix-14). Female, 45. Married, 8 children; 2 miscarriages. Breast abscess on other side 2 years ago. 6 months' duration. Tumor under nipple. No pain. Discharge bloody on pressure. Excised. Papillary cystadenoma. Report, 4 years later, no trouble.

IX. No. 184. 1903. Dr. W. M. Conant (lxxxix-295). Female, 35. Married, 8 children. 1 year's duration. Tumor size of chestnut, under nipple. No pain. Bloody discharge. Amputation. Examination, 4 years later. No trouble.

X. No. 204. 1904. Dr. S. J. Mixter (469-145). Female, 67. Married, children? Duration 2 years. Tumor, size of egg, near nipple. No pain. Discharge not recorded. Amputation. Papillary cystadenoma. Reports, 3 years later, no trouble.

XI. No. 210. 1905. Dr. C. A. Porter. Female, 43. Married, 4 children. 4 years' duration. Tumor, size of small orange, near nipple. Sinus at edge of areola. Painful of late. Discharge from sinus watery and bloody. Amputation. Papillary cystadenoma. Report, 18 months, no trouble.

XII. No. 209. 1905. Dr. R. B. Greenough (42-352). Female, 19. Single. $1\frac{1}{2}$ years duration. Tumor, size of half a hen's egg. No pain. Bloody discharge from nipple. Excision by areola incision. Papillary cystadenoma. 19 months later, examination, no further trouble.

XIII. No. 211. 1905. Dr. Wm. M. Conant. Male, 51. 4 months' duration. Tumor size of walnut. Upper outer quadrant. Pain not marked. Bloody discharge from nipple on pressure. Amputation with dissection of axilla. Papillary cystadenoma. Examination, 16 months later, no trouble.

XIV. No. 205. 1906. Dr. S. J. Mixter. Female, 24. Single, 4 years' duration. Tumor size of lemon, under nipple. Slight pain at time of catamenia. Discharge from nipple bloody and purulent(?). Excision. Papillary cystadenoma. No later report.

XV. No. 206. 1906. Dr. J. C. Warren. Female, 34. Married, no children. 8 years' duration. Tumor, size of walnut. Right breast; lower inner quadrant. No pain. Discharge not noted. Plastic resection. Periductal fibroma and papillary cystadenoma. 6 months later, result perfect.

XVI. No. 208. 1906. Dr. F. G. Balch. Female, 30. Single. 4 months' duration. Tumor, size of walnut, under nipple. Considerable pain. No discharge. Excision with areola incision. Papillary cystadenoma. Result, 3 months later, perfect.

XVII. No. 212. 1906. Dr. C. L. Scudder. Female, 40. Single. 7 years' duration. No pain. Bloody and serous discharge. Plastic resection. Papillary cystadenoma. No later report.

XVIII. No. 216. 1898. Dr. S. J. Mixter (333-177). Female, 52. Married, no children. 9 months' duration. Tumor, 2 inches in diameter, near nipple. Pain slight. Discharge not recorded. Nipple retracted. Skin adherent. No glands felt in axilla. Amputation. Papillary cystadenoma and adenocarcinoma. Died four years later of cancer of the breast.

XIX. No. 215. 1901. Dr. H. H. A. Beach (385-136). Female, 76. Widow, 2 children. 1 year duration. Tumor, size of walnut; upper inner quadrant. No pain; non-adherent. No gland felt in axilla. Amputation. Axilla not dissected. Papillary cystadenoma and adenocarcinoma. Report, 1 year later, no recurrence.

XX. No. 214. 1905. Dr. J. C. Warren. Female, 69. Single. 18 months' duration. Tumor, size of walnut, under nipple. Adherent to skin. No glands felt in axilla. Slight pain. No discharge. Complete amputation. Axilla not dissected. Papillary cystadenoma and adenocarcinoma. 2 years later, examination showed no recurrence.

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PUERPERAL GENERAL PERITONITIS,

REPORT OF ELEVEN CASES.

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THE problems of puerperal infection are still unsolved and, since the introduction of aseptic methods into obstetric practice, no great advance has been made in the prevention and treatment of the condition. While women continue to lose their lives in such large numbers from this condition, little help has been offered by investigation. This disease annually accounts for thousands of deaths in this country, and is more worthy of study than many more abstruse but less important problems investigated by special committees and under special grants.

The course of puerperal infection shows but little difference from that of severe infection in other parts of the body. The great severity of the condition is due to several factors. The pregnant woman is more susceptible to infection, in general, than the non-pregnant, and is prone to disturbances of metabolism which lessen resistance and decrease elimination. The traumatism of labor causes a local disturbance of circulation and the raw surface of the uterus bares a huge surface for the entrance and growth of micro-organisms. The anatomical relations and blood supply of the organs have been temporarily altered and an easy portal of infection is presented by the genital parts of the recently pregnant woman.

Puerperal infection shows varied manifestations and, in itself, is not a sufficient diagnosis of a condition whose varied phases require different treatment. The clinical evidences of puerperal infection are those of a rapidly advancing genital infection. The endometrium, in the majority of cases, is the point of entrance of the micro-organisms and their products. Wounds of the perineum and vagina may become infected but, as a rule, the infection here remains local. If the endome-

trium is the seat of the infection, the micro-organism spreads into the veins and lymphatics and may gain entrance to the general circulation. This is the common course of streptococcus puerperal infection. In this form of infection, the essential lesion is a peri-uterine lymphangitis. This lymphangitis follows a similar course to the common and well known streptococcus infection of the arm, save that it is modified by the more generous lymphatic and blood supply and an adjacent serous membrane—the peritoneum.

This lymphangitis is more commonly associated with thrombosis than with the presence of actual pus in the lymphatics, which is a result only in severe cases, and accounts for Trendelenberg's¹ findings of thrombosis of the uterine and spermatic veins in 21 out of 43 fatal cases, and lymphatic infection in only four. Grossman,² in a study of 51 post-mortem examinations in puerperal infection, found peri-uterine thrombo-phlebitis alone in fourteen instances, and associated with lymphangitis in 13 other cases. However, the frequency of peritonitis, which must be from direct lymphatic extension, shows that the condition is more common than the post-mortem records show. The thrombosis of the peri-uterine veins is a matter of secondary consideration and a comparatively unimportant complication of the disease. The essential lesion is a spreading lymphangitis following the course of lymphangitis elsewhere in the body.

Cuff³ has recorded a case in which laparotomy was done, of a severe puerperal infection with rigors and very high temperature. There was, on vaginal examination, a mass on the right side of the uterus which proved to be the broad ligament, "the thickness of three fingers stretching from the uterus wall internally to the pelvic wall externally." The ovarian vein was tied and the patient recovered. While assisting Noble of Philadelphia, I saw two such cases of puerperal infection in which the broad ligament was thickened, respectively, to one and to two and half fingers in breadth. Both cases got well after closure of the abdomen without further surgical treatment. There was no abdominal pus in either Cuff's case or the two referred to. This condition is, however, a preliminary state

before peritoneal infection. However, the condition may subside before peritoneal infection results, and become spontaneously cured.

This form of peritonitis is usually streptococcic and is marked by severe clinical manifestations, with little evidence of effort at repair on the part of the peritoneum. The local seat of the disease is about the broad ligaments and the pus is found generally distributed within the abdominal cavity, with little or no evidence of repair in the distant parts. Intestinal paralysis soon follows and the streptococcic form of the disease is almost always fatal. Sargent⁴ believes that no recoveries follow this type of peritonitis, but I have seen two cases of general peritoneal infection with streptococcus recover after a simple laparotomy and drainage.

While this type of peritonitis is a most common one in the puerperium, there are other forms in which the infecting organism does not pass through the genital canal, but is the result of the lighting up of a previous focus of infection. Into this class fall all cases of infection from bruising of tumors, rupture of pus tubes, or purulent collections about the adjacent pelvic organs. Any variety of a pelvic tumor may be bruised or have its blood supply cut off by torsion at the pedicle and become inflamed and gangrenous, thus setting up a peritonitis. The important point to recognize is that, in this form, the lymphatics are not involved, and that the treatment is that of a non-puerperal peritonitis from a similar cause. However, it frequently happens, particularly in infection from pus tubes, that there may be associated two infections, one of which is of the nature of a lymphangitis, and the other is the old infected focus lighted up. Thus, as occurred in one of my cases, an old purulent gonorrhoeal salpingitis may become reinfected with streptococci by lymphatic extension and form pus collections. This may rupture, causing a general peritonitis. In this way it will be seen that it is difficult to make hard and fast subdivisions between lymphatic puerperal peritonitis and peritonitis from previous infection.

While the streptococcus is the most common cause of lymphatic peritonitis, other organisms also have a share in its

production. The streptococcus is the most frequent cause of puerperal infection, and in a previous paper ⁵ it was estimated to be the causative organism in 40 per cent. of all cases.

In more recent communications on this subject, Lloyd,⁶ in 159 cases, says streptococci were found in 33 cases, staphylococci in 30 cases, pneumococci in 17 cases, gonococci in 21, colon bacilli in 22 cases and bacillus capsulatus ærogenes in 2 cases. While these statistics are based upon a study of the infection in the puerperium, it has also been shown that the streptococcus is a frequent cause of infection in premature labor and abortion.

The frequency of the incidence of the various infecting organisms, is shown by the following table of eleven cases, in which they occur in about the usual ratio:

TABLE OF CASES.*

Case.	Local Lesions.	Character of Peritonitis.	Complications.	Organisms.
I	Acute hæmorrhagic endometritis.	Acute suppurative.	Acute suppurative endocarditis; septic pneumonia.	Staphylococcus aureus.
II	Abortion; acute suppurative endometritis.	Acute purulent.	Acute suppurative salpingitis.	Pneumococcus.
III	Premature labor.	Acute purulent.	Bilateral gonorrhæal salpingitis.	B. coli; streptococcus; gonococcus.
IV	Abortion; gangrenous endometritis.	Acute purulent, with petechial hæmorrhages.	Acute yellow atrophy of liver.	Streptococcus; B. capsulatus ærogenes.
V	Acute exudative endometritis.	Acute plastic.	Salpingitis; hydrosalpinx.	Streptococcus.
VI	.....	General plastic.	Pyosalpinx.	Streptococcus.
VII	Purulent endometritis.	Acute purulent.	.....	Streptococcus; B. coli.
VIII	Acute endometritis.	Acute purulent.	Abscess of cul-de-sac.	Streptococcus.
IX	Acute purulent endometritis.	Fibro-purulent.	Pericarditis.	Staphylococcus aureus.
X	Acute purulent endometritis.	Acute purulent.	.....	Streptococcus.
XI	.....	Acute purulent, with multiple local collections.	Bilateral purulent salpingitis.	Gonococcus.

* Some of these cases have been referred to before in other communications. A number of them were studied in the Bender Laboratory and some are from the records of that place. Others were studied at the N. Y. Lying-in Hospital and Kensington Hospital for Women.

These cases show that the streptococcus was the infecting organism alone in 3 cases, and associated with other bacilli in 3 cases. Thus, it will be seen that the streptococcus occupies a greater share as a cause of puerperal peritonitis than it does of puerperal infection in general. Also, Sargent⁴ states that, in a study of 258 cases of peritoneal lesions, the staphylococcus albus was found in 108 cases; and he states that this and the colon bacillus form the most important and frequent causative organism concerned in peritonitis, outside of pregnancy. In the cases in which streptococcus was concerned, there were very acute symptoms and marked clinical disturbances. The course was fulminating, and was associated with marked anatomical disturbances in other parts of the body.

Case III, a case of premature labor at the sixth month, showed few symptoms until the seventh day, when there was a high temperature of 104°, with abdominal tenderness and rigidity. The uterus seemed well involuted and there was profuse purulent discharge. The physical examination showed a moderate sized fixed mass on the right side of the uterus. No swelling or mass in the cul-de-sac. The uterine discharge contained the gonococcus and streptococcus. The leukocyte count at this time was 29,000, with 90.5 per cent. polynuclears. On the ninth day after delivery, the patient was taken with sudden severe abdominal pains and marked tenderness and rigidity. The pain was peristaltic in character, intermittent and intense. The tongue was dry and there was slight vomiting. The physical examination showed fulness in the cul-de-sac, with marked tenderness and a disappearance of the mass on the right side; leukocyte count was 11,000, with 90 per cent. polynuclears. Laparotomy showed general distribution of sero-purulent fluid with marked congestion and redness of the viscera. This is most marked in the pelvic region. The right tube had formed part of the wall of an abscess beside the uterus and pus exuded from the fimbriated end and from the cut surface of the broad ligament. Death occurred nine hours after rupture of the abscess. The gonococcus, streptococcus and colon bacillus were recovered from the abdominal fluid.

Case IV was one of criminal abortion at the seventh month, and was seen five days after labor. The pulse was 140 and temperature 102°. There was slight jaundice. The leukocyte count was 19,000, and the polynuclears 86 per cent. Vomiting was continuous until stupor intervened and increased to coma. The patient died on the fifth day after the operation. The autopsy showed acute yellow atrophy of the liver, with general peritonitis. In the fluid was found the streptococcus and *B. capsulatus ærogenes*.

Case V was one in which streptococcic infection was associated with an old pyosalpinx; this caused an acute peritonitis, more marked in the lower part of the abdominal cavity, but which invaded the upper part as well. There was little pus. The hydrosalpinx on the left side was uninfected.

Case VI was a similar case to Case V, save that the peritonitis infection was not as acute, and there had been some attempt at repair by adhesions.

Case VII showed general peritonitis with a large amount of pus containing colon bacilli and streptococci. This followed upon an acute purulent endometritis. Death occurred on the tenth day.

Case X was a similar case, being marked by severe vomiting, a high temperature of 105° and intense pain and rigidity. Death occurred on the ninth day.

While the cases of streptococcus infection showed severe symptoms, the cases of infection with staphylococcus aureus also showed acute clinical manifestations with marked anatomical lesions. In this series the staphylococcus aureus was present in two cases.

In the study of puerperal infection, the staphylococcus aureus has been seldom isolated. Fullerton and Bonney⁷ have found this organism in one out of 54 cases. Lloyd,⁸ in a study of 159 cases, found staphylococcus in 30. The type of infection with this organism seems to be one of great severity, with a tendency toward pyemia and the production of metastatic abscesses.

Such was the result in Case I where, after an apparently

normal pregnancy, the patient was delivered by a midwife. She was seen on the eighth day of the puerperium, profoundly infected. There was marked tenderness and rigidity. Temperature was 104.3° . Death occurred on the next day. No operative measures were attempted. Post-mortem examination showed a large quantity of peritoneal pus with a dull injected peritoneum covered with a small amount of fibrin. The pericardial cavity also contained pus. There were areas of septic pneumonia. Bacteriological examination of the organs and pus showed *staphylococcus pyogenes aureus*.

Case IX was somewhat similar but ran a more prolonged course. The patient entered the hospital on the eighteenth day and succumbed to the profound infection on the same day. Autopsy showed a pericarditis, empyema and general peritonitis with little evidence of repair. The broad ligaments were thickened and firm and there was macroscopic evidence of lymphangitis, pus exuding from the cut surface of the broad ligament. In these two cases, the tendency of *staphylococcus* infection toward extension to the neighboring cavities and metastatic abscesses is well shown.

Gonorrhœal infection is one of the most common varieties of infection in the puerperium, and is the least frequently discovered. It usually causes little or no rise of temperature, but may cause high fever, serious morbid disturbances and death. Stone and myself⁸ found the gonococcus in the lochia of puerperal women in 17 out of 171 cases. This organism was associated with peritonitis in only one case of that series. This is Case III, in which there was a bilateral purulent salpingitis from gonorrhœal infection and, following upon this, lymphatic peritonitis from the streptococcus, rupture of an abscess and general peritoneal infection.

Case XI was one of gonorrhœal infection of the uterus with extension to the tubes and peritoneum. In this case, there was a lesion of gonorrhœal infection before pregnancy, and the disease followed its usual course of rapid extension in the puerperium. The temperature went to 101° and the third day of the puerperium, the pulse was 96. The gonococ-

cus was isolated from the vaginal discharge. Pain, rigidity and a temperature of 103.6° appeared on the fifth day. On the sixth day, indefinite masses in the abdomen and pelvis were made out on abdominal and vaginal examination. Pulse at this time was 120. Pulse and temperature kept high until the seventeenth day when death occurred. Operation was refused. Autopsy showed bilateral purulent salpingitis and a general peritonitis of some duration. Collections of pus were found encapsulated by intestines and adhesions in various parts of the abdomen. The gonococcus was isolated in pure culture. Mann⁹ has reported a somewhat similar case, in which the symptoms came on the tenth day. Temperature was 107° , pulse 120. Death occurred and the post-mortem examination showed a peritonitis from pure gonococcus infection.

Gonorrhœal infection usually extends by direct continuity of mucous membrane, but may, in the soft condition of the genitalia, penetrate the uterine muscle and extend into the broad ligament. Salpingitis is a frequent complication of this infection in the puerperium, as is shown by the study of Stone and myself,⁸ in which we found clinical evidence of extension of the infection beyond the uterus, in 7 out of 17 cases. This extension of the disease may continue, as in Cases III and XI, to cause a peritonitis which is, however, usually localized in the cul-de-sac. The late complications of gonorrhœal infection are more to be feared than is the earlier uncommon general peritonitis. Salpingitis and pelvic peritonitis are the most common results. This is the cause of "one child sterility."

Pneumococcus infection is one of the more uncommon forms of puerperal peritoneal infection, and one of comparatively slight severity, save in isolated cases, as in Case II. This condition resulted in a woman four months pregnant, following an induced abortion. She was seen five days after the induction and was curetted for retained secundines. The pneumococcus was isolated from smears and cultures taken at the time of curettage. The temperature was 102 and continued high until death three days afterwards from peritonitis.

Post-mortem examination showed all the peritoneal sur-

faces to be covered by a sticky, greenish-yellow purulent exudate which was thin between the adherent intestines, but thick between surfaces held apart by collections of fluid. All the dependent parts of the abdomen contained yellowish turbid fibrino-purulent exudate. There was an acute suppurative salpingitis and endometritis. The pneumococcus was recovered from the peritoneal exudate.

While pneumococcus puerperal infection is uncommon, a number of cases have recently been reported. Weichelbaum¹⁰ as well as Bar and Tissier,¹¹ have reported cases; and Cohn one similar to this. Fullerton and Bonney⁷ found six cases of pneumococcic infection in 54 cases of puerperal fever; and Lloyd⁶ found the pneumococcus in 17 out of 159 cases of puerperal infection. The pneumococcus is being more frequently isolated in such conditions, as the bacteriological methods of study improve. That the condition is by no means rare as a cause of infection of the peritoneum, is shown by Annand's and Bowen's¹² collection of 91 cases of pneumococcus peritonitis in children. They found that in half the cases the pus was encysted and that the peritoneal infection was usually secondary to some remote pneumococcal lesion. The exhaustive discussion by Jensen¹³ of this form of peritonitis, gives a thorough idea of the subject. He reports several very interesting cases and gives a list of 143 references.

The character of this form of peritoneal infection is usually that of Case II, reported here. The infection is characterized by a plastic exudate, very rich in fibrin, which causes adhesions and encapsulation of the exudate; quite rarely, in the severer forms, the entire mass of the intestines adhere together and are surrounded by pus. In typical cases, the clinical picture is quite striking; the onset is that of an acute peritonitis, followed, very soon, by a chronic stage with mild symptoms and indefinite masses on abdominal palpation. The diagnosis is never certain without bacteriological examination, although one might suspect this infection from the thin, odorless, greenish-yellow pus and the abundant fibrinous adhesions. The prognosis is, as a rule, favorable; but recovery without

operation is rare. Simple evacuation of pus and drainage of the collections are all that is usually required.

There is, in this series of cases, no instance of peritoneal infection resulting from direct traumatism or necrosis of a tumor from pressure or torsion of the pedicle. A fibroid or ovarian cyst may take on rapid growth during pregnancy, and from torsion of the pedicle or sudden loss of nourishment from lessening of the blood supply after labor may become necrotic and infected. Lepage and Mouchotte¹⁴ have collected a number of such cases. Similar causes lead to infection from ovarian cysts; and Getter¹⁵ has reported 21 cases where, in spite of normal labors, infection of the cyst has occurred and led to fatal peritonitis. The infection is commonly due to the colon bacillus and is usually widespread and severe. Lawrence has reported ten such cases sent to the hospital as peritonitis following a puerperal genital infection. Patton¹⁷ has collected 321 cases of ovarian cysts in pregnancy. In 95 cases treated expectantly until labor, torsion of the pedicle occurred 29 times—4 times during labor and 25 times during the puerperium. Rupture happened 13 times—3 before and 10 after or during labor. There were 25 deaths in the 95 cases, only 4 of which occurred in patients who had operations after labor, and 21 in those who were treated wholly expectantly. General peritonitis occurred in 7 of the 95 cases. There were 184 cases treated by operation, with a mortality of 8 (4.3 per cent.). Infection of ovarian cysts is especially likely to happen in the early puerperium. The teratoid ovarian tumors are particularly liable to be aroused from quiescence to rapid growth during pregnancy. This is well shown by a review of 35 cases by Neuhauser.¹⁸

Appendicitis is another lesion which may cause an extensive and fatal form of peritonitis in pregnancy and the puerperium.

The lessened resistance to infection of the pregnant woman has added to it the local abdominal disturbances of the presence of the mass of the gravid uterus and the increased vascularity of the pelvic viscera. Futh,¹⁹ in his recent papers, up-

holds Waldeyer's statement that the cæcum and appendix are pushed up during pregnancy. This displacement begins about the fourth month, when the uterus rises out of the true pelvis. It then opens up the broad ligaments and the ovarian vessels are enormously increased in size. This elevation of the cæcum is of clinical significance as, in addition to predisposition to disease by reason of the alteration of position, the focus of inflammation is thereby placed in a more dangerous position—*i.e.*, higher in the abdomen, where adhesions are more easily torn and where inflammatory processes spread with greater ease. The cæcum returns to its proper place after labor; but, if the appendix is adherent to the uterus or adnexa, it is dragged into the true pelvis by the involution of the uterus. This may cause rupture of an abscess and increase the extent of the inflammation to the general peritoneum.

Seven casts of the abdominal cavity of women, dying during pregnancy, are described by Futh²⁰ to uphold this view. Five cases of appendicitis in pregnancy are also reported, and he states that appendicitis is much more dangerous after the fourth month, on account of the size of the uterus influencing the position of the cæcum. He has divided Boije's series into two groups. In the first, under four months, there were 10 cases, with three deaths. In the second, from the fourth to the ninth month, there were 32 cases with 19 deaths—a much higher mortality. This seems to be clear proof of the effect of the continuance of pregnancy upon the mortality of this condition. Hlawecek,²¹ in 1897, collected 13 cases of peritonitis from this cause with 11 deaths; but under early operative treatment, the prognosis is brighter.

The diagnosis of generalized peritonitis in the puerperium is by no means easy. The extension of an infection in a woman already severely infected, shows few additional symptoms and small increase of pathognomonic signs. The diagnosis of puerperal genital infection is in itself not always easy, and the presence of pathogenic micro-organisms in the lochia is not proof of infection. Bumm and Sigwart²² found that, by very careful examination, the streptococcus was isolated in the

vaginal discharge of 38 per cent. of women in the later months of pregnancy. Leo,²³ in an examination of the lochia in 38 normal women, in the puerperium, found the streptococcus in the vagina in 50 per cent. and in the uterine lochia in 17.6 per cent. In the later days of the puerperium, streptococcus is more commonly found, as was shown by a study of Schenk and Schieb,²⁴ who found this organism four times more frequently late in the puerperium than at the beginning. They found that streptococci existed in the lochia of one-third of all normal women. Also the discovery of a certain organism in the vagina, although an indication is not pathognomonic of the cause of infection. Sargent⁴ reports a case of gonococcus infection found in the vagina while the peritoneum was infected with the pneumococcus. Stone and myself²⁵ have shown, in a study of the gonococcus, that this organism may exist in the uterine lochia without causing temperature. However, the presence of certain bacteria in the uterine lochia, as shown by smears and cultures, is some indication of the cause of infection.

The time at which the extension of the infection to the peritoneum occurs seems to be very variable. Lymphatic peritonitis from streptococcus usually appears from the third to the tenth day of the puerperium. It is seldom earlier but often later. The time of onset of symptoms of peritonitis from previous lesions also varies within a wide limit, but is usually later in appearance than the lymphatic form.

Pain is usually a prominent symptom, and occurred in all my cases. The pain of peritonitis is, I believe, fairly characteristic, and is a great aid in the diagnosis of the condition. It depends upon two conditions: First, it is now recognized that most of the pain in peritonitis is due to an accompanying lymphangitis. This, in part, causes the crampy pains of peritonitis—the lymph vessels of the intestines press upon the sensory nerves as the lymphangitis extends. The pain in the lymphatic peritonitis is not usually localized, as in appendicitis, but is sometimes referred, like that of appendicitis, to the epigastrium. This is supposed to be due to the infection in the peri-lymphatic tissue and the lymph glands around the aorta.

There seems to be but little pain from lymphangitis of the broad ligament.

The second source of pain is from the exterior of the gut itself, and is due to the presence of an irritant causing an inflammation of the peritoneum. The movement of the intestine causes severe crampy pains. That this pain is due somewhat to the irritant, and not directly to the inflammation, is shown by a case of abdominal hæmorrhage following Cæsarian hysterectomy upon which I did a laparotomy to control the bleeding. After clean hysterectomy there was a sudden flow of blood into the peritoneal cavity. The patient, who had been resting quietly, immediately complained of intense pain in the epigastrium and in the diaphragmatic region, generally. There was difficulty in breathing and nausea. The pain was intermittent and intense. Immediate laparotomy showed that the unclotted blood was generally distributed throughout the abdominal cavity. The character of the pain was similar to that of Case III, in which there was a sudden rupture of a pus collection, causing intense intermittent pain, crampy or peristaltic in character. In addition to the direct irritation and inflammation of the peritoneum, the pain is further caused by the rubbing of the inflamed intestinal covering against the parietal peritoneum. The visceral serosa has comparatively few sensory nerves while the parietal peritoneum is exceptionally well supplied. The pain in the diaphragmatic region, in the two cases cited, was probably due to irritation of the parietal serosa in the area. It is also recognized, however, that peritonitis may exist in the center of the belly, beneath the colon and above the pelvis, amongst the coils of the small intestine, for some time and become widespread without causing marked pain.

That acute abdominal symptoms may be caused by a lymphangitis alone, is shown by a report of Rowland,²⁶ of two cases of operation upon supposed perforation in typhoid fever. Masses of enlarged lymphatic glands were found in the mesentery of the gut without any evidence of perforation or peritonitis. The pain was intermittent and peristaltic. There was

localization of the tenderness with little or no rigidity. Armstrong²⁷ has reported a similar case in typhoid fever; and McCrae,²⁸ in his study of the pain in typhoid fever, cites two cases in which the explanation for the acute symptoms was the enlarged mesenteric glands.

In peritonitis, while the intestines are quiet, pain is not usually a marked feature; but, during peristalsis, it is usually present. For this reason, it is often useful for diagnostic purposes to set up peristalsis and elicit the pain by giving a purgative enema. This usually also gives a clue to the location of the point of greatest inflammation.

Rigidity is usually an early and trustworthy sign. It is present in all cases of peritonitis which were seen at their inception. It was present in the 7 cases of localized gonorrhœal peritonitis, before referred to. Rigidity, however, depends, in some measure, upon the suddenness of the onset of the peritonitis and sometimes does not last long. Intestinal distension usually overcomes it and causes it to disappear. To the educated hand of the surgeon, it is the most reliable early symptom.

Tenderness on palpation is not usually a marked symptom unless there has been marked effort at repair and the formation of much exudate and many adhesions. It may sometimes be produced vaginally by movement of the uterus. It can also be elicited after peristalsis has been set up.

Vomiting is a fairly constant symptom and occurs at two different periods in the disease. First, at the onset, there is usually vomiting, regurgitative in character, and later there is more persistent bile-stained vomiting, often fœcal or hæmorrhagic in character.

The temperature was rather variable in character. In the infection with the more virulent organisms, it went very high and was intermittent in character; but in the last days of the disease, this intermission was not present. In the less virulent infection by gonococcus and pneumococcus, the temperature while high, did not rise above 103°. The pulse in these two instances was also lower than in the more virulent

form. There was, however, nothing characteristic about the less virulent peritonitis. In Case III, after rupture of the abscess, the pulse suddenly rose from 90 to 120 and became of high tension and thready. The pulse is usually a better indication of the condition of the patient than is the amount of fever.

The blood changes of general peritonitis are interesting and instructive. There is usually a diminution in the red cells. This is more marked in puerperal peritonitis, and, in puerperal infections generally, than in infection in the non-pregnant. The leukocyte count is increased as it is in all septic conditions. This depends upon many conditions, as the patient's resistance and the virulence of the infection. It may be said that, as a general rule, in streptococcus infection, the leukocyte count is less in the pregnant than in the non-pregnant. A sudden fall in the leukocyte count (as in Case III, from 29,000 to 11,000) is suggestive of an overpowering of the system by toxins of the infective organisms. The polymorphonuclear leukocytes are usually increased in percentage.

Iodophilia is another useful sign and gives reliable evidence in all septic conditions. After staining with weak solution of iodine (Ehrlich's method), the blood, in cases of septic infection, usually shows a reaction in the cytoplasm of the leukocytes. This iodophilia usually occurs in the polymorphonuclear neutrophile cells and sometimes in the lymphocytes. It does not bear a definite relation to the leukocytosis; but depends upon the amount of toxemia, not upon the leukocyte range. Thus, the blood of a profoundly septic person may show intense iodophilia with a fall in the leukocyte count; while a high leukocytosis, without iodophilia, is not incompatible with an infection exciting a toxæmia sufficient to stimulate the cells to overproduction, but not of a character to affect them structurally. This fact makes the reaction especially valuable in cases of puerperal peritonitis, where there is often sudden overpowering of the system by toxins. An interesting review of the work of Cabot, Locke,²⁹ Dunham,³⁰ Dunn³¹ and Keen³² upon this subject is given by Da Costa,³³ with a report

of 100 cases, including 30 cases of sepsis in which the iodo-philia was present.

It must be remembered, however, that the diagnosis of peritonitis can never depend upon the blood changes which only give confirmative evidence of infective processes. No hard and fast rule in regard to the degree of leukocytosis can be laid down, in spite of efforts of some of the camp followers of scientific investigation to have us diagnose our cases of sepsis in their private laboratories.

The bacteriology of the blood and lochia is of importance in forming an exact idea of the extent and character of the infection. Smears of the uterine lochia often give immediate and useful information in regard to the possible cause of the peritonitis.

Careful physical examination should be made upon all cases of suspected puerperal peritonitis, as it is the exception and not the rule for all patients with severe puerperal peritonitis to be without complications and infection in other organs. Care should be taken to recognize lung and heart complications, and search should be made for metastatic collections. Pyelitis and pyonephrosis are also not uncommon results of infection in pregnancy. The use of the Pravaz or Hollenbeck ³⁴ needle has been suggested for the detection of free pus in the abdominal cavity, but should be used with great care, as there may be adhesions which would cause the bowel to be punctured.

The treatment of uncomplicated puerperal peritonitis is that of peritonitis in the non-pregnant. Immediate laparotomy and evacuation of the purulent matter with removal of the focus of infection, if possible, is recognized by all surgeons to be the proper procedure. While this is true in all cases in which peritoneal infection has resulted from previous foci as pus tubes, abscesses or necrosis of tumors, there is more difference of opinion as regards the value of operation and the procedure in lymphatic peritonitis.

Trendelenberg has advised, in this condition, resection or ligation of the veins of the broad ligament. It is decidedly

questionable whether this operation has any great value, as cases are noted in which recovery has taken place after simple laparotomy. The thrombosis of the veins is merely an incident of the infection, and offers no excuse for the laceration of the broad ligament and the division of the lymphatic channels, to allow the escape of micro-organisms. Hysterectomy, an operation which has been practically abandoned unless there is a local lesion, has more *raison d'être*, for it removed a greater part of the infected surface and allowed of better drainage.

In order to thoroughly discuss operative measures in the lymphatic form of general puerperal peritonitis, a proper knowledge of the processes of infection with the most common causative organism, the streptococcus, is necessary. Streptococcus infection differs from most other infections in that the blood serum does not acquire streptococcal properties, but the destruction of the cocci and relief from the infection is brought about by the leukocytes. There is a relatively small amount of toxin developed and no bactericidal properties in the serum, and it is reasonable to suppose that phagocytosis is an important factor in recovery. In addition to a leukocytosis, there must be an increase in the opsonin, *i.e.*, an increase in the power which prepares the leukocytes to engulf the bacteria. Any substance, then, which aids the body defenses to resist the infection is of use.

Anti-streptococcic sera have been tried for many years with poor results; but recent reports show that properly prepared polyvalent serum has given more satisfaction. Bumm³⁵ reviews his results in 32 cases of severe infection, and in four particularly striking cases of high fever, but without phagocytosis. Hyperleukocytosis occurred 12 hours after the injection of the serum and was intense, the leukocytes incorporating the streptococci with great avidity. Rau³⁶ has reported similar good results, and a reduction of his mortality from 60 to 36 per cent. in streptococcus infection. Escherich³⁷ has also reported beneficial effects in scarlet fever with the Moser polyvalent serum. Anti-streptococcus serum is, however, more of a prophylactic measure against peritonitis and it is doubtful

whether it has much effect after the infection has passed the confines of the uterus. It should, however, be used.

Other substances, however, are used to enhance the resistance of the peritoneum and to increase the activity of the leukocytes. Mickulicz³⁸ used intra-peritoneal injections of nucleic acid and performed operations as soon as the leukocytes began to increase. In 45 cases, the increase varied from 9 per cent. to 452 per cent. Seven cases died, but none from peritonitis, although two recovered in spite of this complication. Diez³⁹ also used nucleic acid and advocates the injection of a 2 per cent. solution as a preliminary to operation.

Hanner⁴⁰ reports 51 cases in which 50 c.c. of the same acid was injected in the form of sodium nucleate 13 hours before operation. Marked hyper-leukocytosis was present in every case. The reaction was always striking, the temperature rising one to two degrees C., with a chill in some instances. He also, as did Gray,⁴¹ used quantities of dead organisms as vaccine, but the effect was doubtful.

It would, therefore, seem that the injection of nucleic acid is a useful adjunct to early operation in generalized peritoneal infection, particularly in infection from the streptococcus.

Operation should remove, if possible, any focus of infection with as little traumatism and handling of the intestines as possible. Lavage should not be performed, as the risk of spreading the infection is too great. The treatment should be after the method of Murphy and consist of making a small opening with the introduction of drainage tubes. Vaginal drainage is often useful. Evacuation of the intestinal contents in cases with paralyzed intestinal walls is sometimes of use. A high rectal tube may answer when the sigmoid is involved. If paralysis be higher than this, enterostomy is necessary.

Peritonitis characterized by abundant sero-purulent exudate and unaccompanied by signs of deep inflammation is a comparatively benign affection provided that operation is timely; but that form characterized by little or no exudate and with the gut wall red, dry, distended and paralyzed, gives an almost hopeless prognosis.

The prognosis, as a whole, in puerperal peritonitis is bad unless early operation is done. However, results are improving, as is shown by 121 cases collected by Jeannin.⁴² These histories extend back to the early days of abdominal surgery, yet there were 60 recoveries and 61 deaths. This showing will be improved with more modern methods of treatment and earlier operation. In cases of puerperal general peritonitis treated expectantly, the result is almost invariably fatal, while in those cases treated surgically there are frequent successes, hence every case of puerperal general peritonitis should be operated upon as soon as diagnosed.

In the after-prognosis of such severe puerperal infections, it should be kept in mind that the late appearance of metastatic abscesses is not an uncommon condition.

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SUBACUTE PERFORATION OF THE STOMACH AND DUODENUM.

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THE condition of "subacute" perforation of an ulcer in the stomach or in the duodenum is one which has received less attention than it merits. It is not infrequent, it is of great interest, and its discrimination from "acute" perforation is of no little importance from the therapeutic standpoint. Since attention was first called to it, only one paper, so far as I am aware, has dealt specially with it; this paper was written, with characteristic ability, by Dr. F. B. Lund, of Boston (*Boston Med. and Surg. Journ.*, 1905, vol. i, p. 516).

I find that in all, I have operated upon 15 cases, 5 of which were dealt with in the early stage, 10 after the lapse of months or years; in 4 an hour-glass stomach was found.

In subacute perforation of the stomach there is a sudden rupture of an ulcer, an ulcer which, without exception in my experience is of the "chronic" type. The chronic ulcer with its deep excavation, its deep edge, and its surrounding induration has eroded the walls of the stomach little by little, until finally and abruptly the thin barrier between it and the peritoneal cavity is broken through. The conditions are, up to this point and in these particulars, in no way different from those existing in "acute" perforation. But whereas in the latter form the rupture is of fair size and at once allows the contents of the stomach to spread themselves freely over the general peritoneal cavity, and to cause there a universal infection (though the path followed is often recognizable, and can not seldom be predicted), in subacute perforation there is, by one agency or another, a definite localization of the fluids escaping from the stomach, and in many instances a narrow circumscription of the peritoneal response to their invasion.

It becomes, therefore, a matter of interest to know the circumstances under which this limitation is affected. I have seen examples of the following:

(1) An empty condition of the stomach. In "acute" perforation the stomach is often full; the rupture of the ulcer, it is frequently remarked, occurs soon after a meal. If the stomach be empty, say 5 or 6 hours after a meal, perforation may still occur, but there is, of course, little or no escape of contents.

In such circumstances, the ulcer may be ruptured by a violent strain, a sudden movement, or a severe shake. It is not long before a most vigorous defence is made by the peritoneum, lymph is thrown out copiously in flakes, and a thin serous fluid begins to fill the peritoneal cavity. The escaping contents of the stomach being small in quantity and feeble in bacterial activity, are rapidly circumscribed.

(2) The plugging of the opening in the ulcer with a tag of omentum. Of this, I have seen one perfect example. The ulcer was close to the pylorus, its opening small; into this opening there fitted, as accurately as any cork, the bulbous end of a thin omental tag which came upwards from the greater curvature of the stomach. There was not any adhesion of the stomach to the abdominal wall, or to the overhanging liver; nor was there need for any, for a more perfect plugging of an opening could not be conceived. The little omental tag seemed quite to have grown into the opening which it so securely closed.

(3) The opening may be sealed over by layers of plastic lymph. When the abdomen is opened, a clear or slightly turbid fluid is found, but no ulcer is apparent. At some part of the stomach wall a thick adherent mass of plastic lymph will be seen, as thick as wash-leather, and in appearance very similar. On peeling this off, a small perforation is found, from which a bubble may be squeezed. This condition may be a later stage of that already referred to (No. 1), but it is equally possible that as the ulcer deepens, the peritoneum is irritated, and protectively deposits layer after layer of lymph upon the outer

side of the base of the ulcer, so that when the final dissolution of the stomach wall occurs there is already a barrier almost or entirely impenetrable, to check the escape of the stomach contents.

(4) The stomach becomes adherent at the base of the ulcer. The adhesion may be to the anterior abdominal wall, to the under surface of the liver, or to the pancreas. Other points of adhesion are recorded, but they are unusual and I have not met with them.

The adhesion to the anterior abdominal wall is the most frequent, as would be expected from the usual position of perforating ulcers in the stomach. It is possible that adhesion of the ulcer is only a later stage of No. 3, the plastic lymph becoming welded on its outer side to an adjacent firm structure, and that as the ulcer deepens, the lymph is digested until the actual base of the ulcer is formed by the muscles of the abdominal wall, by the pancreas, or by the liver.

At the place in the abdominal wall where this adhesion occurs, a tender and resistant area can readily be distinguished, and a diagnosis of the condition made with confidence. In one patient whose ulcer had perforated "subacutely" years before, the base of the ulcer was formed by the posterior sheath of the rectus, and a hard mass had formed at this point. A diagnosis of malignant growth had, not unnaturally, been made. (See Case XV).

SYMPTOMS.

In every particular save one, that is intensity, the symptoms are the same in subacute as in acute perforation. There is a sudden onset of pain, severe, and almost intolerable, but measurably less than in acute perforation. The pain comes almost without exception in those who have suffered for years or months from the usual symptoms of gastric ulceration. There are some cases in which there has been a notable exacerbation of pain in the days preceding the rupture, and patients have explained to me that the body or side felt stiff, and sore, that laughing or stretching, as in reaching up to a high shelf

caused great discomfort. (See Case II.) These inaugural symptoms of perforation are important, and if the practitioner chances to hear of them from a patient whom he knows to have an ulcer in the stomach, he should accept them as undoubted evidence of impending perforation. In my own experience perforation of an ulcer has never occurred without a previous history of gastric ulcer being given. The pain is sudden in onset, and may be followed rapidly by vomiting, prostration and possibly (though rarely) by collapse. The abdomen on examination is everywhere tender. A careful examination may reveal an especially tender and resistant area. A patch 2 or 3 inches in diameter may be excessively sensitive, and on palpation it may seem as though a flat hard disc had been inserted in the abdominal wall.

The symptoms abate slowly. The pulse does not increase, its character improves, vomiting ceases; the abdomen which was hard and retracted at the first, may become supple except at the one spot, or it may be a little distended, and free fluid may possibly be recognized. The patient's condition may indeed, at this stage, be so satisfactory, as compared with the initial condition, that the diagnosis may be in doubt. If indeed morphine has been given, as it still very often is, in repeated doses, the aspect of the patient may be little different from the normal. If no operation is practised at this time, there are three directions which affairs may take; either a perigastric abscess may form, or a secondary rupture into the general peritoneum may occur, or the adhesion of the ulcer to the abdominal wall or liver or pancreas may become firmer, the acute inflammatory conditions subside, and the patient live for years with a chronic ulcer whose base is formed by one of the structures already mentioned. Of the three I believe the last to be the most common.

DIFFERENTIAL DIAGNOSIS.

The conditions likely to be confused with subacute perforation of the stomach or duodenum are few. The chief difficulty in diagnosis arises in discriminating a subacute perfora-

tion near the pylorus, from a condition of cholecystitis. In both, there are pain, sudden in onset, severe, possibly colicky; in neither is there any general invasion of the peritoneum; in both a localized peritonitis with a tender resistant area is recognized. The previous history may afford a clue, but is not likely to do so. Lund, in the paper already mentioned, gives notes of a case in which it was considered possible that a perforation of a malignant growth in the colon had occurred.

In one case of subacute pancreatitis which went on to the formation of an abscess, from which I removed a large slough of the pancreas, I had diagnosed a posterior subacute perforation of the stomach followed by subphrenic abscess. This mistake is one which, from clinical signs alone it would be difficult to avoid.

In my own cases a correct diagnosis was made without difficulty in almost every case.

TREATMENT.

If the patient is seen at the time of the onset of perforation, I think there can be no hesitation in advising instant operation. In the first place accurate and unequivocal discrimination between acute and subacute perforation cannot be made, and by delay valuable time may be lost. Moreover, though it is true that many of the subacute cases, with rest in bed, abstention from food and so forth, may progress to the chronic stage, there are indubitably other possibilities, which, when reckoned with, make early operative treatment the safe and prudent course. In all the cases I have seen in the early stage, save one, I have operated and have cleared the ulcer of adhesions, infolded it, and occasionally sutured a flap of omentum over the line of stitches. I did this at first because I did not distinguish between the acute and the subacute cases; I did it subsequently because it had seemed to be the right course to have pursued in the early cases. Dr. Lund has, however, suggested that since the perforation is already sealed off, there is no need to expose and then close the rent afresh, and that, accordingly, the proper course is to perform gastro-enteros-

tomy forthwith, leaving, if possible, the ulcer and its secure barriers untouched. He writes:

The treatment of an open perforation is manifestly to invert the edges of the ulcer and close it by suture. The ulcer has already perforated into the general cavity and the peritoneum is soiled. In these subacute perforations, however, nature has already closed the perforation, and if we can get along without tearing the adhesions, opening up the ulcer and soiling healthy peritoneum, we give our patient a distinctly better chance. In case the ulcer is on the anterior surface or lesser curvature and is to the right of the median line, and the adhesions are to the inferior surface of the liver, there is nothing to prevent our turning up the posterior surface of the stomach and performing a posterior gastro-enterostomy without breaking up the adhesions, opening the ulcer, or soiling the cavity with stomach contents. We provide internal instead of external drainage for the ulcer, and we operate in a region where the peritoneum and gastric wall are healthy instead of inflamed, and where our opportunity of getting perfect healing is the best. And last, but not least, we give the best treatment to the underlying condition of chronic ulcer to which the perforation has been due.

This I believe in some cases, more especially those in which the pyloric part of the stomach or the duodenum are involved, will prove to be the best practice. In other cases, however, in those for example where the ulcer is on the anterior wall of the body of the organ, and a wide area is covered with lymph, and adherent, I think that the exposure and suture of the perforation, followed or not by gastro-enterostomy will be the proper course to adopt.

In those cases where years have elapsed since the initial catastrophe, a separation of the ulcer from its adhesions is certainly unnecessary, and is probably most undesirable. For these, gastro-enterostomy is the operation to be advised if the pyloric part of the stomach is involved. If the cardiac end of the lesser curvature is involved, gastro-enterostomy is here also desirable, but a separation of the ulcer, if readily performed, is also good practice.

In four cases I have found an hour-glass stomach, the ulcer at the isthmus of the organ being firmly fused to the anterior abdominal wall. On separating the stomach an opening was found in its walls, and it at once became clear, that the base of the ulcer had actually been formed by the abdominal wall itself.

The following are the notes of all the cases upon which I have operated. They may be divided into three classes. In the first, Cases I to XI, the operation was performed when the perforation was recent. In the second, Cases VII to XI, when the perforation was of old standing. In the third, Cases XII to XV, when an hour-glass stomach was present.

CLASS I. RECENT SUBACUTE PERFORATION.

CASE I.—*Recent Subacute Perforation of an Ulcer on the Anterior Wall of the Stomach.* A female patient, aged 24, seen March 13, 1902. Had been married 8 weeks previously. Before that she had suffered slightly from indigestion, but never severely. Thirty-six hours before operation she was suddenly seized before breakfast with acute pain beneath the left costal margin. There was no vomiting (the stomach probably being empty, after a night in bed, the last meal being supper the night before); faintness and collapse were present. The abdomen which was generally tender became gradually distended and on examination was thought to contain free fluid. In the upper left quadrant of the abdomen, beneath the outer part of the rectus, was an area which was very acutely tender.

When the abdomen was opened through the left rectus muscle a thick localized deposit of yellow plastic lymph was found over an area about 2 to 3 inches in diameter. On peeling this off, a small perforation, almost pin-point in size, was seen; it was in the middle of a hard and indurated area the size of a shilling. When sutures were passed to infold the ulcer they cut through at once; so that a fairly large area had to be infolded by sutures that were not tightly drawn. Over the suture line, a broad flap of omentum was turned and fixed by two stitches. There was a fair quantity of perfectly clear, slightly yellow inodorous fluid in the abdomen. The abdomen was closed. Re-

covery was satisfactory. In July, 1905, the patient was quite well, and had borne two children.

CASE II.—*Recent Subacute Perforation of the Stomach.* The patient, a girl aged 18 years, was seen November 8, 1902. For the last few weeks she had had some slight pain after food just beneath the left costal arch. The pain had been worse when she laughed and when she stretched her left arm upwards. There was a sudden onset of symptoms about 8 P.M. on November 7—pain, collapse, shallow breathing, etc. The abdomen was intensely rigid and immobile. The perforation was about equal in size to a lead-pencil and was situated near the lesser curvature towards the cardia. There were many flaky adhesions covering the perforation completely and sealing it off. A little clear fluid in the peritoneal cavity. The ulcer was sutured and an omental flap was turned over it. There was no drainage. The patient recovered. Reported to be quite well in June, 1905. In domestic service.

CASE III.—*Recent Subacute Perforation, Followed by a Second, Separate Acute Perforation of the Stomach.* A woman, aged 23 years, was seen March 5, 1903. She had had indigestion for several months. On March 1, when in London, she had a sudden attack of pain beneath the left costal margin; she felt faint and prostrate, and vomited. She gradually felt better and on the 3rd traveled from London to Bawtry and ate a good luncheon on the journey. The side then felt "stiff" and hurt her if she laughed or turned quickly. On the 4th after breakfasting she had a sudden extremely severe pain, with collapse and vomiting. The abdomen had gradually distended and was now blown out and tympanitic; a fluid wave was easily felt. The patient looked very ill. The pulse was 156. Two perforated ulcers were found, both on the anterior surface and in the cardiac half of the stomach near the lesser curvature. They were distant about one and a half inches from each other. One opening was of the diameter of a lead-pencil and the other of a knitting needle. From both, fluid gushed out. Both were closed by suture and the stomach was folded over. The omental lid afterwards covered both in. Drainage was effected by a split tube and a gauze wick at the upper part of the incision and through a separate suprapubic incision. Recovery ensued. Gastro-enterostomy subsequently performed. Quite well in 1905.

CASE IV.—*Recent Subacute Perforation of the Duodenum. Enormous Deposit of Plastic Lymph.* The patient was a girl, aged 17, who had suffered for twelve months from indigestion, and for years from anæmia. Four days before I saw her she had a very severe attack of pain in the right side and across the abdomen, vomiting and faintness. When the abdomen was opened there was a little clear fluid and around the duodenum a very thick tenacious plastering of all the parts with lymph. This was wiped away with rough gauze, the process requiring time and patience. Eventually a minute duodenal perforation was found about 1 inch beyond the pylorus. The ulcer was infolded, and the abdomen drained in front and behind. The patient recovered, and was reported well in March, 1906.

CASE V.—*Recent Subacute Perforation of Duodenum.* A man, aged 22, was seen May 11, 1904. He had been quite healthy up to beginning of April, 1904, when he felt a slight pain in the abdomen. This only lasted a few minutes and then passed off. Three weeks later he was seized with extremely acute abdominal pain. Within three minutes he was in a state of complete collapse. The pain was most severe in the epigastric region at first; later it was most acute in the lower part, and in two or three days it settled in the right iliac region. He vomited at the beginning, not again later. There was slight constipation. He recovered very rapidly. He went out for a stroll on the ninth day. Incision made over appendix. Appendix found lying along outer side of ascending colon and adherent in all its length. It was removed. The hand passed up into the liver region, felt numerous adhesions. A second incision was made over the gall-bladder. Numerous recent adhesions of the gall-bladder to liver and duodenum were separated, also a very strong one between the duodenum and under-surface of the liver. On examining the surface of the duodenum thus bared, a minute perforation was seen. This was occluded by Lembert sutures and abdomen closed. The patient recovered. In June, 1905, reported to be quite well.

CASE VI.—*Recent Subacute Perforation.* March 24, 1904, female, aged 25. Indigestion twelve years. For many years she had had acid eructations, and for the last two years has vomited after food. She has had many severe attacks of pain in the epigastrium. Four days before admission and again one day before she had attacks of pain and vomiting, but not any more

acute than many she had had before. During the last three years her weight has dropped from 9 st. to 5 st. 8¾ lbs. At the operation, perforation, the size of a small pea, was found in the upper part of the first portion of the duodenum. The ulcer was about the size of a half-crown. There was severe local plastic peritonitis, but no general infection. The perforation was closed by Lembert's sutures, and a posterior gastro-enterostomy performed. The patient recovered. She was sent by Dr. Rowling. Report received from Dr. Rowling June 26, 1905: "Gained 2½ st. in weight during the three months succeeding the operation."

CLASS II. OLD SUBACUTE PERFORATION

CASE VII.—*Old Subacute Perforation.* June 4, 1902; female, aged 27. Five years ago had an acute attack of abdominal pain, vomiting, etc. Was in bed 22 weeks. The doctor who saw her and the consultant, diagnosed "perforating" ulcer of the stomach. Constant indigestion, pain, and vomiting since then; can never take solid food, and ordinary liquid diet causes pain and uneasiness. Vomits every three or four days now. Stomach moderately dilated. At the operation, very dense and numerous adhesions were found on the posterior surface of the stomach, especially thick and tough near the pylorus, where the stomach was almost fused to the pancreas. A fairly large stomach. Posterior gastro-enterostomy. The patient recovered. The patient was seen with Dr. Millhouse and Dr. Anning. Since the operation the patient has had three serious attacks of her old trouble, apparently, each one less severe than the preceding one. Since August, 1904, she has had no symptoms of a return, and to all appearances the cure is complete. Her appetite is good, and she eats the food usually going in the house without any ill effects. Weight at the time of operation, 6 st. 6 lbs., and on July 6, 1905, 8 st. 1 lb.

CASE VIII.—*Old Perforation, Probably Subacute.* September 16, 1902, female, aged 37. Has had indigestion for "many years." Eighteen months ago she had "perforated gastric ulcer" of the subacute type, diagnosed by Dr. Bishop. Since then her stomach symptoms have been intolerable. Pain constant and gravely increased by food of any kind; vomiting at least every other day, fermentation and eructation of obnoxious gas. She has vomited frequently half a chamber-utensil full of

sour semi-digested food. She has "lost a lot of flesh." The stomach is very large, obviously standing out on her thin abdomen. The washing out required 49 pints before the fluid returned clear. Free HCl. At the operation, the stomach was found buried in adhesions to both anterior and posterior surfaces. The whole outline of the stomach was warped. The posterior surface was exposed with some little difficulty owing to adhesions to transverse mesocolon and to the pancreas. It was probably here that the perforation had occurred. Posterior gastro-enterostomy was done. I was dissatisfied with the way in which the anastomosis seemed to "sit" after returning within abdomen. Reflux vomiting occurred; 132 ounces of deeply bile-stained fluid were vomited in two days. I, therefore, reopened the abdomen and performed an enteroanastomosis between the afferent and efferent limits of the anastomosing loop. The patient recovered. The patient was sent to Dr. R. W. S. Bishop, Kirkby Malzeard. She gained 9 lbs. in weight. She often remarked: "I'm surprised at myself eating so much." Report received from Dr. Bishop, June 28, 1905: "I saw Miss B. last night and send you following particulars of her present condition. General condition excellent, far better than for several years before she had perforation, strong, able to walk with ease to and from Ripon—five miles, both ways ten miles—and even farther. No anæmia, well nourished and in good spirits, apparently in perfect health. No gastric pain or discomfort, no nausea, vomiting or flatulence—"body much smaller than before operation"—no attacks of distension as before. Bowels more or less regular, and kept all right by aid of brown bread and similar rough food. Able to eat everything. This year has eaten more salads than for many years past. Had one attack of indigestion in two years, not of long duration; generally careful not to eat most indigestible foods.

CASE IX.—*Old Subacute Perforation; Adhesion to Pancreas.* September 25, 1902, female, aged 60. Has been failing in health for 9 to 10 months. The chief symptom has been vomiting. At the onset a sudden seizure of vomiting, very acute and lasting over 24 hours. There has been a series of attacks of vomiting. Pain is noticed about an hour before a meal is due, and lasts from a few minutes to two or three hours; is never very severe. She has lost flesh and has got weaker, occasionally having to spend a part of the day in bed. No melæna. No hæma-

temesis. A small, hard tumor felt above and to the right of the umbilicus, a little movable. On distension with CO₂, an enormous stomach, reaching a full hand's breadth below the umbilicus. At the operation a very large stomach was found. On the posterior surface of the stomach one large ulcer with several thick adhesions around it. In the second portion of the duodenum the tumor was found. It was a mass about the size of a large walnut, adherent to the pancreas, with which it seems inseparably connected. The duodenum above this point looks distended. Probably chronic duodenal ulcer with interstitial pancreatitis. The patient recovered. The patient was sent by Dr. Welch, Staningley. In Jan., 1903, she was eating heartily, and was free from all discomforts. Report received from Dr. Welch, June 21, 1905: "I saw Mrs. B. to-day. She tells me that she has enjoyed excellent health since the operation, and has had no stomach trouble of any sort. She certainly looks very well, and she does all the housework at her own home."

CASE X.—*Old Subacute Perforation; Adhesion to Pancreas.* December 14, 1904; female, aged 50. Perforation of an ulcer occurred 9 months ago (probably). There was acute peritonitis of sudden onset, intense epigastric pain, collapse, vomiting, etc. For more than a month she was extremely ill. The general peritoneal involvement subsided, and epigastric fulness, tenderness and rigidity remained. Since then has had constant pain after food, often intense, vomiting, inability to take solid food, and marked wasting. At the operation, an ulcer about junction of middle and pyloric third, absolutely welded to the pancreas. Gastro-enterostomy on proximal side. The patient recovered. She was sent by Dr. Bertram Watson. Report received from Dr. Bertram Watson, June 21, 1905: "Mrs. T. is in good health. The operation completely relieved her stomach symptoms, which, you will remember, were of 14 months' duration. I do not know what increase of weight there has been, but she tells me that she can eat anything now with impunity."

CASE XI.—*Old Subacute Perforation; Adhesion to Abdominal Wall.* January 7, 1905; female, aged 45. In May, 1904, an acute attack of abdominal pain, and vomiting, followed by distension. It was thought that there might be a rotation of an ovarian cyst, but the acute illness subsided in a few days. Since May, 1904, has suffered much from pain after food, vomiting,

etc., and has lost weight. Since her confinement, six months ago, has noticed a swelling at the lower part of the abdomen. On examination now, a hard lump, just to the right of the middle line, adherent to abdominal wall. In lower part of abdomen an ovarian cyst, equal in size to a six months' pregnancy. At the operation, incision made between umbilicus and pubes; a large ovarian cyst springing from the right side. Much glairy fluid in the peritoneum. No twist of pedicle. An examination of the stomach showed a hard mass at pylorus, which was adherent to abdominal wall. Probably a "subacute" perforation of a gastric ulcer. Posterior gastro-enterostomy. The patient recovered. She was sent by Dr. Macaulay, Halifax. She was reported well in 1906.

CLASS III. SUBACUTE PERFORATION. HOUR-GLASS STOMACH.

CASE XII.—August, 1899; female, aged 39. Ten years ago the patient had an illness characterized by profound anæmia. Seven months ago there were clear symptoms of ulcer of the stomach, but neither then nor at any time any acute illness suggestive of perforation. Now vomits after all ordinary food and more often than not, even after small quantities of fluid food. Pain after food was exceedingly severe. On examination of abdomen a dilated stomach could be felt. At one point, a little to the left of the middle line, and slightly below the ensiform cartilage, was an area 2 inches in diameter which was markedly tender, and offered increased resistance on palpation. This area was found at the operation to correspond precisely with the area of stomach adhesion. The patient had lost weight and deteriorated seriously in general health during the last few months. At the operation an hour-glass stomach was found. The narrow constriction was near the middle of the stomach, and adherent to the anterior abdominal wall over an area equal to a crown piece. On each side of this the stomach dilated and seemed to be anchored by the adhesion. On separating the stomach from the abdominal wall an opening into the viscus was exposed and the stomach contents escaped. The opening was enlarged transversely and the wound and fistula were stitched up vertically. An omental graft was brought to cover in the sutured area in order to guard against future anchoring. The

patient recovered. For a month after the operation there was pain at times and loss of appetite. Since then she has been free from pain and in excellent health. Appetite and digestion are good. The patient was seen with Dr. Bailey, Horsforth. In Feb., 1902, her condition was still perfectly satisfactory. In Oct., 1903, the patient was reported to be in perfectly good health—"in excellent condition." In July, 1905, in sound health. "A complete cure."

CASE XIII.—April 6, 1901; male, aged 46. Symptoms for 12 months; pain, heaviness, discomfort after meals; loss of weight and general deterioration in health. At Christmas had a sudden attack of acute pain and hæmatemesis, and was very ill for several days; since then has never taken any food (solid or liquid) without pain. Has noticed on several occasions that the stools were "black as ink." Vomits now every day. At the operation 2 ulcers were found near the pylorus, one on gastric, one on duodenal side. A mass equal in size to a walnut was found at the pylorus. Pylorus was very narrow, adherent to liver, and gall-bladder by dense bands. At the middle of a hugely dilated stomach was a constriction that would admit 4 fingers. Posterior gastro-enterostomy to pyloric pouch. At the necropsy 2 ulcers (duodenal and gastric) were found, the former very adherent to the gall-bladder; the latter had perforated into a mass of adhesions, its base being partly formed by the pancreas. The patient died. The patient was sent by Dr. Crawford Watson, Harrogate. All went well for 3 days; then a large prolapse of rectum (from which he had previously suffered) came down during the night, and was not discovered for 4 hours. When I saw him the prolapse was livid and œdematous, and could not be reduced until ether had been administered. From this time patient became gradually worse; the temperature ran up to 104 and 105, and he died 4 days later. The following is an abstract from the necropsy record, written by Dr. Maxwell Telling: "The stitches are quite sound, the opening good, and surgical technique perfect. No peritonitis. The hæmorrhoidal, and inferior mesenteric veins are full of disintegrating clot (septicæmia)."

CASE XIV.—January 14, 1904; female, aged 35. First attack October, 1901; acute sudden pain, faintness and collapse. In bed for a fortnight then; the chief physical signs being exquisite local tenderness and fulness in the epigastrium. Ever

since has had pain about one hour after food, relieved by vomiting. No hæmatemesis. She recovered April, 1902, and then kept well up to December, 1903. She then had pain and flatulent distension about an hour after meals, with regurgitation of highly acid fluid. On January 13, 1904, about one and a half hours after a light meal and while sleeping in a chair, she was seized with sudden violent pain and became collapsed. I saw her about 1.30 P.M., January 14,—*i.e.*, about 18 hours after the onset of acute symptoms. On opening the abdomen the stomach was found to be adherent by recent lymph to the under surface of the liver. On separating the adhesion, a small perforation was found. It was closed by two layers of Lembert's sutures. It was now noticed that the puckering of the chronic ulcer had caused a narrowing of the stomach at about its middle. Gastroplasty was performed. The patient recovered. In March, 1905, was in perfect health, had gained weight and was eating well. Seen with Dr. Baskett, Halton.

CASE XV.—February 8, 1904; female, aged 42. Sudden onset December, 1900, while lifting a heavy weight. She had had pain and vomiting almost every day since. In July, 1901, a tumor was noticed in the abdomen; this tumor has not increased in size. She has once vomited bright blood. She is fearfully emaciated; her weight has gone down from 8 st. 9 lbs. to 5 st. 7 lbs. There is a painful tumor to the left of the umbilicus. The veins of the anterior abdominal wall are much distended. Incision made over tumor. This was found to be a large inflammatory swelling formed by the base of a large ulcer of the stomach adherent to the anterior abdominal wall. The ulcer was at the junction of two pouches. The ulcer was cut away and the stomach closed. The condition of the patient was so bad as not to allow time for a gastro-enterostomy. The patient recovered. Her doctor reports early in 1905: "Gained 2 st.; eats anything and does her own housework." In July, 1905, symptoms were beginning again, and it seemed not unlikely that gastro-enterostomy will be necessary. In August, 1905, gastro-enterostomy was performed; the patient recovered, and is now (March, 1906) in good health.

REPORT OF A CASE IN WHICH A LARGE NUMBER OF FOREIGN BODIES WERE REMOVED FROM THE STOMACH.*

BY ARTHUR E. BENJAMIN, M.D.,

OF MINNEAPOLIS, MINN.

THE literature is quite full of cases operated upon for the removal of foreign bodies from the stomach, but as a rule these individuals seek the advice of a surgeon only when the suffering becomes intolerable. A great many foreign substances have been removed at post-mortem from the stomach.

When the stomach is not dilated or ulcerated, and when the pylorus is patulous, gastrotomy is sufficient, with the removal of the foreign bodies. A gastro-enterostomy is occasionally demanded on account of the obstruction at the pylorus. The case I have to report is as follows:

Mr. E. W., aged 47, American, 4 feet 11 inches tall, weighs 140 pounds. His occupation is that of glass and nail eater. Has eaten glass for 20 years and it never troubled him until February, 1906. Has swallowed 8- and 10-penny nails and horseshoe nails for the last five years; a few were passed in stools. Has swallowed pieces of glass as large as his thumb. Mouth has been cut several times, anus cut once. Stools have been black only during the last five or eight months. Drinks a gallon of water at a time in one minute. Has drunk 40 gallons of water in a day. Four years ago had a hæmorrhage from stomach after drinking 12 gallons; bled about one pint. Is a contortionist, eats fire and is a strong man. His last attack came on while in St. Louis, five weeks ago. He was on the street when he was taken suddenly with severe pain across stomach and in region of heart. Was taken to hospital in St. Louis and remained there three weeks until he came here, two weeks ago. Was fairly

* Read before a joint meeting of the Crow River Valley and Meeker Co. Medical Societies, at Litchfield, Minn., Oct. 10, 1906.

well until two days ago when he was taken again and laid up in bed for a couple of days.

Patient vomits considerable matter of a black color, which tastes like iron rust. Stools are of a black color. Has a feeling of weight in his stomach. Has lost about 25 pounds in weight in the last five months. Has not lost strength at all, but is short-winded. It hurts him to breath, especially to do deep breathing, which produces the sensation of a knife cutting in his stomach. There is a constant steady pain which becomes worse at times. Says that he can feel objects in his stomach at times.

Habits.—Uses tobacco moderately, has been an inveterate drinker until eight months ago, since which time he has drank no alcoholics. Appetite and sleep good. Bowels are constipated. Patient is well nourished, muscular; bends with his teeth an iron rod $\frac{3}{4}$ inches in diameter. Straightens out horseshoes, breaks rocks with his fist. Tongue not coated or scarred, of good size. Upper lip shows scar to right of median line. Eyes normal. Two fingers are gone from left hand.

Family History.—Father died at 65 years of stone in bladder. Mother died at 75 of cancer of stomach. Two brothers well, two dead,—one of blood poisoning at 49 years, one of consumption and Bright's disease at 39 years.

Previous and Present History.—Married. Has had 8 children, of whom 2 were still born and 4 died in infancy. Two are living and well. Patient was kicked in head by horse 22 years ago, receiving only scalp wound. Was in hospital 5 years ago and had first 2 fingers of left hand amputated. Was also in hospital three months ago for stomach trouble. At that time stomach was washed out but no foreign matter obtained.

Condition on Admission.—Teeth in good condition—very short. Mouth and pharynx negative. Cannot take a deep breath. Stomach dilated two fingerbreadths below umbilicus—very tender. Temperature between 97.5° and 99.5° ; pulse between 98 and 100. Chief symptoms: Pain, vomiting, black stools, loss of weight, feeling of foreign body in stomach.

Urine: Normal except a few pus cells. Blood: June 11, 1906, 3 P.M., hæm., 90 per cent.; R. B. C., 4,600,000; W. B. C., 10,200.

Operation, June 13, 1906. General condition of patient: Good before operation. Ether. Pulse before operation 90;

pulse after, 100. Operation commenced 9.05 A.M., completed at 10.30 A.M.

Description of Operation.—Vertical median incision—stomach greatly dilated. Induration found at pyloric end. The stomach wall was greatly thickened in places, in others showing scars of healed ulcers. The wall was generally very friable and with difficulty held the sutures. Posterior gastro-enterostomy. Two rows of Pagenstecher thread and one row of catgut; Lembert sutures. Irrigation of stomach. Dry dressings, cigarette at top of incision. Fifty-two nails were removed through the opening made. (Fig. 1.) Some of them were as small as shingle nails, but most of them 6- 8- 10- and 20-penny nails removed from sacculated cardiac end of stomach. These were in various stages of erosion, two being like darning needles. Also 5 pieces of thin glass removed.

The nails were in bunches and a number of them imbedded in the stomach wall and surrounded with exudate, making their removal more difficult and accompanied by some hæmorrhage. The extra suture row was used to prevent a leak, owing to the possibility of some of the sutures cutting through the friable wall.

This case was of especial interest because of the particularly bad condition of the stomach, viz.: the ulcerated areas; the thickened walls which were hypertrophied and fibrous in places where old ulcers had healed; because of the friability of the stomach wall along the greater curvature, and, especially, because of the obstruction of the pylorus and the large size of the organ.

This patient did not vomit after the operation. He made a rapid convalescence, and on the fifth day insisted on eating solid food. On the seventh day he was out of bed, as he declared himself well. On the ninth day he could not be persuaded to stay in the hospital longer and went home. The following day he was around town looking for a job, and on the twelfth day he called at my office demanding the nails, as he stated he had a chance to make \$5.00 that evening by exhibiting the same, and was only persuaded to leave without them by the loan of a dollar, to pay board, as he said. He stated since leaving the hospital he was eating regular food and felt



FIG. 1.—Foreign bodies removed from stomach.

well. Four days later, while in a neighboring city, he was seized with severe pains in the stomach. He was taken to a hospital and kept quiet for a few days when he was out again.

He has since called at my office stating that he had suffered occasionally but was comparatively well.

SARCOMA OF THE SMALL INTESTINE AND MESENTERY.

REPORT OF A CASE IN WHICH SIX FEET AND FIVE INCHES OF THE SMALL
INTESTINE WERE REMOVED, WITH RECOVERY.

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Consulting Surgeon to the Nuneaton Hospital.

ON May 22, 1906, I was asked by Dr. Joseph to see with him at the Nuneaton Hospital, a boy aged six years, who was admitted on May 19 with abdominal pain and sickness, associated with a temperature of about 100° . Six weeks previous to the child's admission he had also suffered a similar attack with diarrhœa, and a month before admission the abdomen was noticed to be enlarged.

As soon as the child was admitted to the hospital the symptoms subsided, until May 22, when he again began to vomit after the administration of an aperient, but the bowels acted with the assistance of an enema given some hours after the administration of liquorice powder. When I saw the child he looked ill, his temperature was about 100° and his pulse also, he had a tumor larger than one's two fists occupying the central parts of the pelvis and the lower abdomen, reaching well above the umbilicus; it was movable laterally and vertically, was firm in consistence and free from tenderness. The position of the swelling, its mobility and the history of the pain, sickness, and, on one occasion, diarrhœa, suggested to me that the tumor was one of the great omentum dragging upon the colon, and the mobility was so free that I determined to attempt the removal of the growth.

The abdomen was opened slightly to the left of the middle line, when it was found that the surface of the growth was covered by, and seemed to be intimately blended with, the great omentum, the very large vessels of which ramified over the sur-



FIG. 1.—Sarcoma of small intestine.



FIG. 2.—Section through the growth and intestine.

face of the tumor; the hand passed into the pelvis detected a wide band of adhesion at the posterior surface of the bladder. The great omentum was ligatured off and the bladder adhesion also; the hand passed under the tumor and it was lifted out of the abdomen. It was then discovered that a coil of small intestine ran right through the middle of the growth, as is well shown in the accompanying Fig. 1. Following the tumor upwards it was found that it encroached very much on the mesentery of the small intestine and that to remove it and yet leave a sufficient blood supply to that portion of the small intestine which remained behind a very extensive resection of intestine would be required. The blood supply to the small bowel was double ligatured, piece by piece, by the aid of an aneurysm needle thrust through the mesentery, the ligatures extending from close to the ileo-cæcal valve, upwards until it was evident that the place was reached which was above the growth and yet left the small bowel well vascularized. The mesentery was now divided between the double ligatures, and the bowel also at the extremities above and below the growth, scarcely any blood was lost and only one or two fine points needed further ligatures. The upper end of the lower piece of small intestine, which was quite close to the ileo-cæcal valve, was inverted and closed by sutures, the lower end of the upper portion of the small intestine was approximated to the lateral wall of the ascending colon by means of a Murphy button and the abdomen was closed.

A comparatively uneventful recovery followed, the pulse record was at its highest, 128, on the first night and remained above 100 for ten days while the temperature which at the end of 48 hours was 101 gradually fell to normal, the button was passed on the twelfth day. While the boy remained in bed he had two, sometimes three, rather loose motions every day; he has been kept under observation since he left the hospital and his weight has been taken on several occasions. On June 14, he weighed 30 lbs., and on July 8 the weight had steadily gone up to 36 lbs., while at the present time he is just 3 stone; he appears well in all ways, but his motions remain too frequent and often very offensive.

Examination of the removed parts shows that the tumor is a round-celled sarcoma, the origin of which may have been either in the wall of the small intestine or in the mesentery close to it;

careful measurement of the removed part of the bowel shows that it is 6 ft. 5 in. in length.

The case is of interest not only on account of the extensive removal of the small bowel and the good state of nutrition in which the boy now is, but, also, because of the little impediment to the intestinal current afforded by such a long tract of rigid and infiltrated and therefore passive intestine.

CONGENITAL LUMBAR HERNIA, AT THE TRIANGLE OF PETIT.*

BY CHARLES N. DOWD, M.D.,

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LUMBAR hernia has been a subject of scholastic rather than surgical interest, and there has been much discussion as to its exact anatomical location.

Under the following four headings are included the supposed sites of exit from the abdominal cavity which have been most discussed. (1) The triangle of Petit; (2) the superior lumbar triangle (or rhombus), described by Grynfeldt¹ and Lesshaft,² and situated just below the twelfth rib. The ilio-costal muscle forms the posterior boundary of this space, and the external oblique the anterior; the serratus posticus inferior and the end of the twelfth rib are above it and the internal oblique below it; the latissimus dorsi lies over it. (3) A defect in the aponeurosis of the latissimus dorsi is described by Braun.³ (4) Lieber⁴ and Hartmann have described inconstant defects in the wall of the lumbar region near the triangle of Petit which could be the sites of lumbar hernia. The condition is so uncommon that few cases have been observed and very few reports of dissections have been recorded. MacReady, in his *Treatise on Ruptures* (1893), states that "of hernia in the lumbar region very few have been found and only one has been dissected" (not referring to those which follow abscess or injury).

In the *Atlas and Epitome of Abdominal Hernias* by Georg Sultan (1902), the statement is made that "post-mortem examination and exact dissection have never yet irrefutably proved that Petit's triangle formed the hernial orifice in any

* Presented before the New York Surgical Society, Nov. 28, 1906.

case of lumbar hernia," and that a similar statement could be made concerning the superior lumbar triangle. These statements were made after studying the analysis of 29 cases which Braun had made in 1879, and the 51 cases which Grange⁵ and Besendonk had made at a later time.

Baracz in an exhaustive article on the subject in Langenbeck's Archives in 1902 (Bd. lxxviii, s. 631-677), states that lumbar hernias are uncommon and not sufficiently understood and that only three cases are known where the place of exit was verified by autopsy. He reported and collected enough cases to bring the total number to 68, including the congenital, traumatic, and spontaneous varieties and those following cold abscess. In order to determine the most probable place of exit of these hernias he dissected the lumbar regions of 38 cadavers and published drawings of each case. He thinks that the triangle of Petit is not likely to be the site of the hernia but rather the superior triangle or rhombus already referred to. He named this the "*spatium tendineum lumbale*." It was present in 95 per cent. of his dissections. He called attention to the defect in the aponeurosis of the internal oblique muscle here and to the passage of the subcostal nerve and the accompanying artery and vein. He considers the next weakest spot in the lumbar region to be in the tendinous part of the *latissimus dorsi* where the *ramus lumbalis* and the ileo-lumbar vessels go through.

There has been one case of lumbar hernia shown before the New York Surgical Society, by Dr. Coley, in 1901, and he referred to another which had been successfully operated upon in the Hospital for the Ruptured and Crippled.

The condition is manifestly not common and the writer therefore presents this patient and the accompanying photograph and drawings which depict the hernia and the operation for its cure.

The child, who is three and a half years old, was brought to him when three months old by Dr. Eversfield, for a protrusion in the lumbar region. This was about the size of a goose-egg,



FIG. 1.—Congenital lumbar hernia, presenting through an enlarged triangle of Petit.

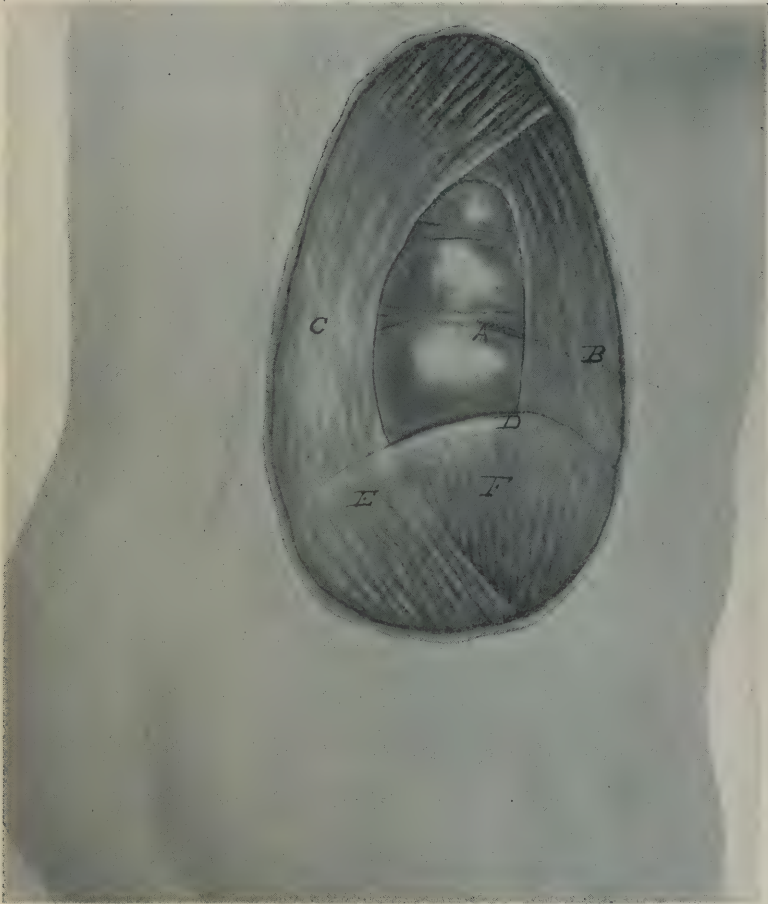


FIG. 2.—Congenital lumbar hernia. *A*, Transversalis fascia. *B*, External oblique muscle. *C*, Latissimus dorsi muscle. *D*, Crest of ilium. *E*, Gluteus maximus muscle. *F*, Gluteus medius muscle.



FIG. 3.—Operation for the cure of congenital lumbar hernia. Flap composed of fascia lata and aponeurotic part of gluteus maximus and medius. Stitches placed for suturing this flap to the lumbar fascia, to the external oblique muscle and to the latissimus dorsi muscle and for drawing the upper parts of the latissimus dorsi and external oblique together.

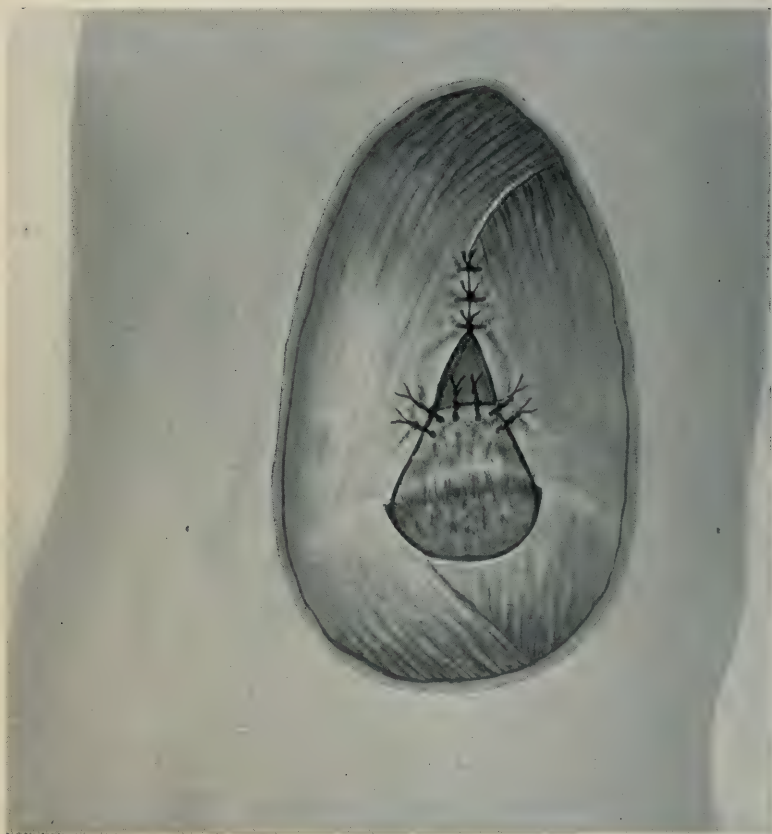


FIG. 4.—Stitches tied, leaving a triangular defect above the flap.

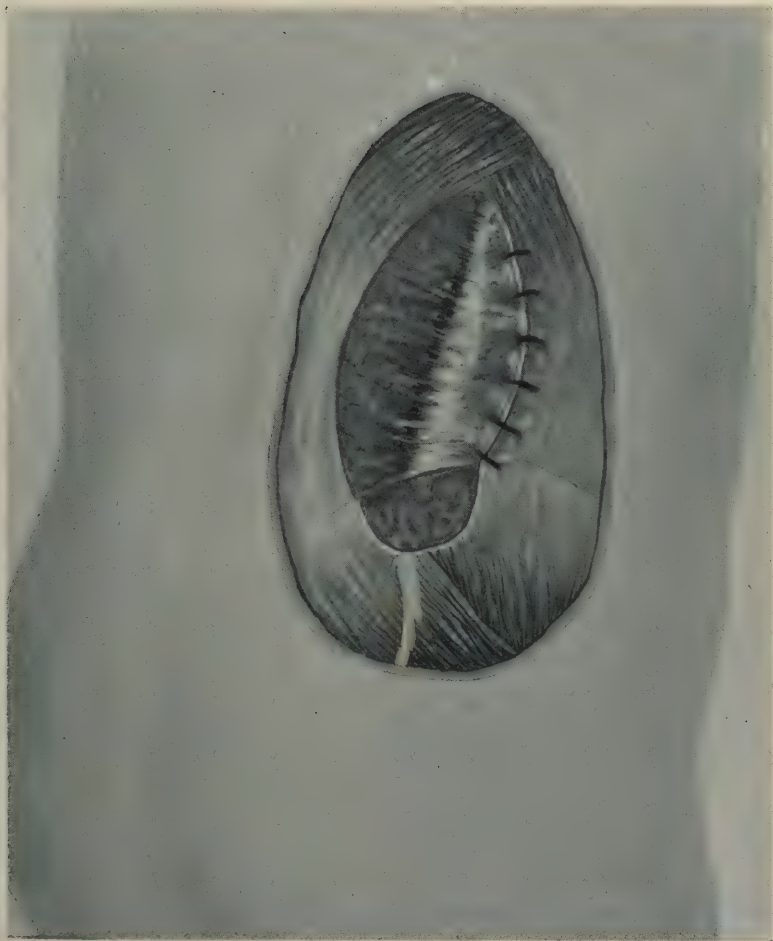


FIG. 5.—Triangular defect and sutured area covered in by a flap from the aponeurosis of the latissimus dorsi muscle.

and the margins of the hernial openings could be distinctly felt and corresponded to Petit's triangle. An elastic belt was applied and held the protrusion well in position for more than two years, but as the child grew the hernia also increased in size, and the accompanying weakness was a menace to the child and consequently a source of much anxiety to the parents. Its appearance is shown in Fig. 2. The opening was larger than the palm of one's hand and bulged in a marked way on coughing or upon exertion. There were two transverse constrictions across it, and in the lower part there was a distinct soft nodule.

On incision the hernia was seen to come through the triangle of Petit, which was greatly enlarged. The transverse bands were thickened portions of the lumbar fascia. The sac of the hernia was distinct, but there was no narrow neck. The nodule at the lower end was the appendix vermiformis. This was removed; a portion of the sac was exsected; and the tissues were then brought together from the sides; the margins of the external oblique and the latissimus dorsi being drawn together as far as possible. After this was done, there was, however, a triangular defect above the crest of the ilium. An effort was made to close this in with an aponeurotic flap turned up from below. The fascia lata and the aponeurotic tissue about the insertion of the gluteus maximus and medius formed a fibrous layer which could be used as a flap, and which was turned up, having the attachment at the crest of the ilium as a hinge. This was stitched in place with chromic gut. Some sutures passing through the previously mentioned transverse band, some through the edge of the latissimus dorsi, and others through the edge of the external oblique muscle. There was, however, still a triangular defect above the flap, and this, together with the repaired area, was covered by turning forward a flap cut from the aponeurosis of the latissimus dorsi. This was stitched to the external oblique.

The closure of the defect was satisfactory, but the operation had the prime defect of leaving a large amount of ill-nourished tissue in the wound, and much chromicized gut which was used for stitching. The greatest possible strain was put upon this tissue, since the child promptly developed pneumonia, and at a later time German measles, and there was a suppuration of the wound. In spite of these complications, however, the result is good and the lumbar wall is firm, eight months having elapsed

since the operation. He walks and holds his body well, and does not seem to suffer from the injury which has been done to the aponeurotic structures of the region.

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TUBERCULOSIS OF THE BLADDER.

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IN the preparation of the following article I have studied 413 cases of tuberculosis of the bladder which I have collected from the literature, and 34 others from Dr. Halsted's wards in the Johns Hopkins Hospital and my private practice. I have examined the preserved tissues from cases of bladder tuberculosis, and have gone over all of the records pertaining thereto in the Johns Hopkins Pathological Laboratory. By the kindness of Dr. Cullen I have been permitted to study additional material from Dr. Kelly's gynæcological service. I have also obtained specimens of this disease which have been preserved in other institutions; and in order to observe more fully its beginning and course I have inoculated the genito-urinary organs of guinea-pigs and rabbits, and watched as far as possible the development of the morbid process.

The literature of this subject is very voluminous, and the conclusions as to the surgical treatment are various and contradictory, rendering it difficult to arrive at the truth. The general impressions, however, which I have obtained from this perusal, in conjunction with my personal experience, have led me to the conclusions set forth in this paper.

HISTORY.

Prior to the fifteenth century there are no descriptions of disease of the bladder sufficiently clear to enable one to identify instances of vesical tuberculosis. And indeed, up to the writings of Ambroise Paré there are no records of this disease. After him there is no mention made of it until Bayle cited a number of cases of genito-urinary tuberculosis, and concluded that the process might be limited to the bladder, or at least not extend beyond the genito-urinary organs.

Lænnec in 1819, in his exhaustive clinical and pathological study of general tuberculosis, found in several subjects that the disease was localized in the genito-urinary organs, and in the description of these cases he gave a very precise autopsy picture of tuberculosis of the bladder. Following him, John Howship in 1823 and Larcher in 1827 described this malady in some detail, the latter being the first to note the presence of tubercles in the vesical mucous membrane.

Cruveilhier, in his characteristically thorough manner, studied several examples of this affection, and was of the opinion that next after the kidney the bladder most frequently became implicated. No notice was taken of this observation until recently when it has been proved to be correct.

Rayer in 1841 made very accurate and beautiful drawings of various tuberculous lesions of the bladder and kidneys; several of these remain unsurpassed in clearness.

After a thorough study of a large number of cases, Wilkes in 1859 concluded that the bladder was never the primary seat, disease of the kidney always preceding its implication. Gebhard, in his admirable thesis, concurred in this opinion. Guyon and Lancereaux a few years later, on the other hand, expressed the opinion that the bladder was in most instances primarily affected, and that the kidneys were implicated by ascension. The profession seems to have been influenced largely by these teachings and to have generally adopted this view. Gradually, however, these ideas lost ground, and it is now known that the bladder is almost never the primary seat of tuberculosis. Moreover, the work of Cayle, Baumgarten, and others has proved that the disease rarely ascends to the kidney.

FREQUENCY OF BLADDER TUBERCULOSIS.

In 2390 general autopsies in the Johns Hopkins Hospital Pathological Laboratory, tuberculosis of some organ was found 710 times; in this number one or more of the genito-urinary organs was involved 160 times; the bladder was affected 22 times, but in no case was the disease primary in this viscus. The kidneys were affected 131 times (in 111 with miliary and

in 20 with chronic tuberculosis), the prostate 17 times; the Fallopian tubes 16 times; the uterus 11 times; the epididymes or testes 9 times; the ureters 9 times; the urethra 4 times; the ovaries thrice; and the vagina twice.

Saxtorph in 10,016 autopsies found 547 instances of tuberculosis of the genito-urinary organs. There were 342 instances of acute miliary processes in the kidney, but only 4 of miliary tubercles in the bladder. In 205 cases of chronic genito-urinary tuberculosis, the bladder was involved *alone* only once, but in 52 cases there was a secondary implication of it—in 38 men (622 autopsies) and 14 women (3,894 autopsies). In the 38 men the kidney was implicated 32 times, the prostate 29 times, and the seminal vesicles 20 times. In the 14 women, the kidney was tuberculous 13 times, and the genital organs 3 times.

Von Groenow in 82 deaths from general tuberculosis found 14 invasions of the genito-urinary organs, among which there were 10 bladder implications. Posner in 115 tuberculous kidneys recorded 12 infections of the bladder (autopsy report). Heiberg in 16 instances of primary genito-urinary tuberculosis in the male observed implication of the bladder 11 times. In 13 cases of primary tuberculosis in the female, the bladder was implicated 8 times. In 32 instances of secondary infection of the genito-urinary tract in the male, the bladder was affected 9 times. In 22 in the female, 9 times. In the male series, there was no instance of an isolated bladder tuberculosis; in the female there was 1. Matile, in 1726 autopsies for tuberculosis, found that the genito-urinary tract had been invaded 123 times; among this number in 19 the bladder was tuberculous.

In 31 cases of genito-urinary tuberculosis noted by Goldberg the bladder was implicated in 23. There were 35 bladder infections in 51 cases of renal tuberculosis studied by Gaultier. Jullien, after a careful examination of 41 instances of tuberculosis of the prostate, records implication of the bladder in 13. Extension to the bladder was discovered by Desnos thirteen times in 16 cases of tuberculosis of the prostate. In 23 cases

in which Israel operated for tuberculosis of the kidney the bladder had become infected in 11. Among 23 patients suffering from genito-urinary tuberculosis whose cases were recorded by Krzywicki, there were 13 who had bladder lesions.

PATHOLOGY.

The latest and by far the most comprehensive work which has been done on the pathology of tuberculosis of the bladder is by Motz and Hallé. I have adopted in part their classification and have not hesitated to draw largely on their descriptions.

We shall divide, somewhat arbitrarily I admit, tuberculosis of the bladder into the four following stages:

- (1) The period of invasion and formation of tubercles.
- (2) The period of superficial ulceration.
- (3) The period of deeper infiltration.
- (4) The period of more widespread destruction.

It is impossible to strike the boundary lines between these periods, for in some bladders they are so merged one into the other that nothing definite can be made out in regard to the stage. The third, that of infiltration, is usually the last, for the fourth, the period of destruction, occurs only seldom.

(1) STAGE OF INVASION.—It is rare that one has the opportunity of observing the very beginning of tuberculosis of the bladder. I have chanced on it once in a case of infection coming from the prostate.

The tubercles (according to Hallé and Motz) are usually situated in the lower half around the orifices of the ureters or in the trigone; they vary in size, from the smallest ones which are scarcely visible, up to that of a mustard seed. At first they are gray, transparent or hyaline, sometimes resembling minute cysts; others do not show this transparency, but are opaque from the onset; as they become older they assume a yellowish tinge. Both the yellow and the gray tubercles project slightly from the surface, each being surrounded by a faint rosy zone which is made up of injected blood vessels. The epithelial layer over them in the earliest stage is intact,

but gradually loses its lustre, begins to exfoliate and later becomes necrotic. As the age of the tubercle advances there is a loss of substance at the apex and the formation of an extremely minute ulcer. This last picture is very seldom seen, for usually there is a coalescence of several tubercles before the ulcer is formed.

Following very closely the above described process, there can be made out a number of other tubercles springing up very close to the older ones, which in a short time merge with them, and form a conglomerate mass the size of a pea. This appears as an opaque projecting nodule which is covered with an intact lustreless and partly necrotic mucous membrane. This stage is the immediate predecessor of the ulcer.

Histologically, the tubercle appears to develop in the capillary zone just beneath the epithelium, and just above the derma. This situation was interpreted by Clado as meaning that the infection of the bladder was through the blood, and was not a direct contamination from the urine. Such a belief, however, is contrary to clinical observation and to many pathological facts. The development, therefore, of tubercles in this region, is probably explained by the entrance of the tubercle bacilli to the deeper layers through a small crack or fissure or by direct penetration.

The very first change which the presence of tubercle bacilli brings about is a slight dilatation of the minute blood vessels; immediately following this there is a proliferation of the connective tissue which gives rise to the formation of lymphoid cells; these at first are scattered, but they soon become more or less aggregated, and in the centre of such cell masses the epithelioid type appears. As the stage advances, by the use of careful staining methods, a change can be made out in both the epithelioid and lymphoid cell; the former presents a more granular protoplasm with a less vesicular nucleus, whereas the nucleus of the latter is much more deeply stained. Just at this time one or more typical giant cells are visible, and an invasion of leukocytes occurs. The cells in the centre soon begin to show more and more signs of degeneration

until, finally, actual necrosis takes place and a microscopic cheesy mass is formed. The overlying mucous membrane at this time presents definite alterations, the blood vessels are slightly engorged, the epithelial cells have a granular protoplasm and a less clearly defined nucleus, and soon begin to exfoliate. The endothelium of the blood vessels immediately surrounding the tubercle proliferates, causing a thickening of the wall and occasionally occlusion of the lumen. The bacilli at first are more or less evenly distributed throughout the cell aggregation, but later they tend to disappear from the centre and are seen only in the periphery.

(2) STAGE OF ULCERATION.—Occasionally one observes a necrosis of a single microscopic tubercle with the formation of an extremely minute ulcer; as a rule, however, several tubercles coalesce, necrose and slough, thus forming a much larger ulcerated area. The latter is usually the type which is first discovered and which marks the beginning of the stage of ulceration. The ulcer spreads itself irregularly in the surrounding mucous membrane, partly by the springing up and secondary necrosis of tubercles in its border, and partly by the erosion of the walls due to the tuberculous toxins.

As seen in this stage, then, the ulcerated area will measure from 2 to 5 mm. in its widest part; it is very irregular in shape, with small arms, which project into the surrounding tissue, and edges that are ragged, worm-eaten, and overhanging, or in other words, undermined; the base is covered by a very delicate anæmic granulation tissue, over which is irregularly spread a fibrinous exudate. The tissue immediately surrounding the edges is somewhat swollen, slightly indurated, and irregularly reddened. Lying in this red zone or outside of it, one can usually discover gray and yellow tubercles, which are irregularly scattered, or may form a definite ring. Two or three ulcers with their adjacent tubercles can generally be found in the same bladder; these may merge into each other, or an intact strip of mucous membrane may be left between them. Occasionally they are single, as reported by Broca, Clado, Coplin, Kümmel, Strauss, Battle, Fenwick and Burckhardt.

The ulcer, as a rule, involves the submucosa, but does not usually penetrate to the muscle; more rarely it completely erodes the submucosa and exposes the muscle, forming what is called a trabeculated ulcer; in still rarer instances it penetrates the entire muscular coat.

On histological examination, one sees that the surface of such an ulcer is covered by a thin layer of necrotic fibrin, immediately below which is tissue made up of small round cells, leukocytes, epithelioid cells, fibrinous masses, and dilated blood vessels, together with scattered cell aggregations showing a tubercular arrangement. The walls of the blood vessels show varying degrees of endothelial proliferation. In the lower layers of the ulcer, as the muscle is approached, there is an extensive round-celled infiltration, but no tubercles. Throughout this granulation tissue, tubercle bacilli are present; they are arranged in clumps, irregularly scattered among the cells with a tendency to aggregation in and around the tubercles.

Trabeculated Ulcer.—The active ulcer after eroding the submucous tissues lays bare the fibres of the muscle which in turn form its base; these being covered by only a thin layer of granulation tissue give rise to the formation of an uneven trabeculated surface. The edges of such an ulcer do not differ from those of the type first described, except that they are thicker, more ragged, and slightly more overhanging.

This type of ulceration occasionally continues to erode the muscle, and as a result ragged muscle fibres are seen projecting from the base.

Histologically the granulation base is formed of lymphoid cells, polymorphonuclear leukocytes, dilated blood vessels with an occasional attempt at the formation of cell aggregations resembling tubercles, but not usually developing into one definitely visible. The muscle itself is infiltrated with small round cells; this invasion is usually limited to the muscle immediately surrounding the base of the ulcer, but sometimes is much more extensive.

Granulation or Vegetating Ulcer.—Projecting from the

sides and base of this type of ulcer are vegetations in the form of a dark velvety fringe or definite papillomatous masses. The larger of these projections are irregular in shape and occasionally are pedunculated as a result of the erosion which has occurred on their sides. The base of such an ulcer shows only a small amount of necrotic fibrin, and the edges are not so much undermined as is usual in other forms. This variety is infrequent, and when found has resulted from a very chronic kind of tuberculosis which is neither virulent nor progressive.

Histologically these vegetations present the cellular arrangement of ordinary non-tuberculous granulation tissue; some of the larger ones contain epithelioid and giant cells, an indication that they have been invaded by tuberculosis. The tubercle bacilli are not present in those which are made up only of granulation tissue.

Another and still rarer type is seen when the muscle has become eroded; here the projecting masses contain bits of muscle as well as granulation tissue.

The muscle in the stage of ulceration is always hypertrophied from the overwork caused by frequent micturition.

(3) STAGE OF INFILTRATION.—As the ulceration increases and penetrates nearly to, or into, the already thickened muscle, the tuberculous process, either directly or by its toxins, sets up in it an inflammatory reaction which is evidenced by the widespread infiltration with lymphoid cells and leukocytes, which in turn give rise to a subsequent development of fibrous tissue. Some specimens show only such an inflammatory change; in others there is a general dissemination of the tubercle bacilli, with a consequent formation of tubercles scattered throughout the tissue. The muscle which was hypertrophied before, now becomes much more thickened by this infiltration, more irritable, and consequently more responsive to stimulation; as a result there ensues an exaggeration in the frequency of micturition. As this stage progresses, there is a degeneration of the muscle, and a replacement of it by connective tissue, which gradually interferes with its contractile power, so that the bladder becomes unable to empty itself.

The ulceration in this stage of infiltration advances and finally becomes so extensive that there is almost complete erosion of the whole mucous membrane. In one case that I have observed, the mucosa was so nearly destroyed that there remained only small fragments here and there. Fenwick observed a bladder in the infiltration stage in which all the mucous membrane was exfoliated except the trigone. Kidd, in a similar bladder, found the inside lining a mass of granulation tissue, except over a small portion of the right lateral wall. Krzywicki records an example in which entire destruction of the whole mucous membrane and extensive invasion of the muscle were noted. In an exceptional instance, reported by Haeffner, half of the bladder mucous membrane was necrotic, although the muscle was not infiltrated nor the bladder contracted. In a specimen shown to me in the Baltimore City Hospital by Dr. Rohrer, there were only a few islands of mucous membrane left, and the muscle was nearly everywhere exposed and extensively thickened by infiltration and hypertrophy.

The wall of a bladder in the stage of infiltration is always thickened, sometimes enormously so, and the whole organ is very much reduced in size, so that its capacity ranges from 100 cc. to 20 cc. Immediately surrounding the outside of the bladder there is formed a somewhat thick layer of inflammatory tissue.

The histological structure of the ulcerating surface and of the muscle in the above condition has already been described.

Caseous Massive Infiltration.—This is a rare variety of the stage of infiltration. For its production two factors are necessary: First, very virulent micro-organisms, and secondly, a very feeble resistance on the part of the tissues. In this form there is a very diffuse spreading out of the tuberculous process on the surface of the bladder and a rapid invasion of the muscular coat with widespread caseous degeneration. The mucous lining of the bladder is covered with grayish-yellow caseous masses which project and render the surface uneven; hanging here and there from these masses and the mucosa are

detached flakes of necrotic fibrin. There are few or no ulcerations. The muscle wall has been changed over a considerable extent into cheesy material, and what remains has undergone a partial disintegration. This wholesale destruction of the muscle has deprived the bladder of its tone and its power to contract, so that it is usually found distended; exceptionally it appears half contracted with rigid walls. The connective tissue outside of the muscle is rarely invaded.

Histologically there are large masses of grayish-yellow, entirely structureless material; around these areas in the still vital tissue are numerous rapidly necrosing tubercles. The muscle which remains is filled with small round cells, the individual fibres are slightly shrunken, the protoplasm of the muscle cells is granular, and the nuclei show a beginning fragmentation. Here and there one can see the outlines of single fibres surrounded by degenerated tissue, giving one the impression that the connective-tissue framework of the muscle has remained while the actual cell has vanished. Tubercle bacilli are present in enormous numbers, and frequently other organisms, particularly streptococci, have aided the work of destruction.

Diphtheroid Form.— This is a variety which is difficult to classify, but more nearly conforms to the infiltrative type than to the other processes. In this there are virulent tubercle bacilli, to which are added streptococci, or a very active form of the colon bacillus. The picture is that of an acute process, and shows an extremely rapid and extensive invasion of the mucous membrane and the muscle, which gives rise to the formation of an enormous yellowish-gray fibrinous exudate. Such a bladder has no unchanged mucous membrane; in fact, it is entirely covered by this dirty gray material, which forms a thick fluffy coat of various hues due to the different stages of necrosis. This fibrinous exudate is very intimately connected with the underlying mucous membrane and when separated from it leaves a bleeding surface. There are no ulcerations. Dittel and several others have reported such a condition of the bladder.

Histologically there is a very extensive inflammatory

reaction, as shown by a general lymphoid and leukocytic infiltration, an enormous production of fresh tubercles and extensive localized areas of necrosis, but an almost complete absence of large masses of cheesy degeneration as seen in the massive type. The picture, therefore, resembles more closely that of a streptococcus inflammation, to which has been added the formation of the multiple tubercles. The exudate is made up of coagulated and necrotic fibrin and resembles somewhat that seen in diphtheria.

(4) STAGE OF DESTRUCTION.—In this stage the muscular coat has been more or less completely destroyed by a rather slow chronic type of tuberculosis and has been eroded, its place being taken by a granulating membrane. The bladder has lost its contractile power and has been converted into a distended flaccid bag. Throughout this newly formed tissue the tuberculous processes may or may not be present; there are usually no active lesions and occasionally the tuberculosis has entirely disappeared. Motz and Hallé have observed and very carefully described several such instances.

Heiler found at autopsy so complete a destruction of the bladder that it was difficult to find any remnants of it; in its place was a small granulating sac, with a fistula into the vagina, through which the urine continually dribbled.

Varieties.—Casper speaks of instances in which tubercle bacilli sometimes spread over the mucous membrane very quickly and produce a picture of an acute process not unlike a true cystitis. He terms the process a tuberculous cystitis, in contradistinction to a tuberculosis of the bladder. Such a differentiation is not needed and tends to confuse rather than to elucidate. A cystitis of this kind is rarely, if ever, the product of tubercle bacilli, but is usually due to the invasion of pyogenic organisms.

Bryson has made the unique observation of what he calls a localized parenchymatous tuberculous cystitis. He observed in a male on the anterior wall of the bladder a spiral-shaped spot the size of a silver dollar, which presented over its surface dark spots, but an intact epithelium; the remaining mucous

membrane appeared normal. At first he did not understand its nature, but later, after finding tubercle bacilli, he decided that it was a rare type of a tuberculous lesion.

Stoeckel reports a very interesting condition which showed a number of polypoid excrescences; these appeared as raised pale areas, most of which were transparent; others were simple oedematous spots; and a few were grayish red. The trigone was normal except that it was very strongly injected; the bladder mucous membrane was entirely free from tubercles and ulcerations; no tubercle bacilli were to be found in the urine; but an inoculation of a guinea-pig was positive, thus proving that the process was tuberculous. I have seen a similar picture in a male, which was undoubtedly not tuberculous, but was due to the effects of an irritating substance in the urine. It seems to me, therefore, that Stoeckel's case might have been an instance of tuberculosis of the kidney, the bladder lesions being caused simply by irritating toxins. In another case, Stoeckel found definite tuberculosis of the bladder, which from time to time almost entirely disappeared, and then returned.

Mirabeau records the case of a female in whom he observed, some time before death, an ulcer in the bladder, but at the time of observation he was not able to discover any other tuberculous lesion. This ulcer was watched by cystoscopic examination and observed to heal; moreover, there was a complete subsidence of the symptoms for one year; although in the bladder, during this time, different spots of inflammation could be made out. One and a half years, presumably, according to his report, after the healing of the ulcer, the patient developed tuberculosis of the lungs and died. A second patient had several attacks of what appeared to be, from cystoscopic examination, inflammation of the bladder, but was proved to be tuberculous by the finding of tubercle bacilli in the urine; in the interval the symptoms became quiescent and the lesions in the bladder cleared up. Such an observation tends to confirm the idea of Casper. In a third instance, along with active ulcers, were found old scars which Mirabeau took to be healed foci.

Pericystitis.—In the later stages the bacilli themselves, or their toxins, probably the latter, get into the tissues immediately outside of the bladder and set up an adhesive inflammatory reaction; this produces a matting together of the bladder with the rectum, small intestines, etc. Englisch has observed and very carefully described this condition. This process does not usually show definite tubercles except in the last stage.

Mixed Infections.—I cannot state with any degree of exactness the percentage of the cases in which a secondary infection occurred, for the reason that in the majority of the reports no mention was made of the presence or absence of other organisms. In those which I have personally examined, pyogenic bacteria were absent from bladders which had not been catheterized, and present in those in which the catheter had been used. I do not mean that all infections are brought about in this manner, for there are innumerable instances in which a secondary invasion has been present without any instrumental interference. The pathological picture presented in a mixed infection differs slightly with the type of the organisms, but the picture is usually that of a tuberculous process with the addition of an ordinary inflammation. Some pyogenic organisms stimulate the activity of the tubercle bacilli; others have no effect upon them and a few are believed to even retard their growth. The organisms which have been found are colon bacilli, streptococci, staphylococci, gonococci and the proteus group. Streptococci and staphylococci, particularly the former, tend to increase the activity of the tubercle bacilli; colon bacilli do not aid their growth but produce a definite cystitis and in this way aggravate the symptoms; the proteus group sets up an ammoniacal fermentation which very greatly increases the pain and burning in urination, but possibly lessens the activity of the tubercle bacilli. Gonococci have occasionally been found; Crismore, Schüchardt, Casper, Motz and others, have reported such contaminations. As a rule the gonococci are present in the early stages and disappear in the later; they produce a gonorrhœal cystitis which renders the

bladder more susceptible to tuberculosis and sometimes seems to determine the starting point of this disease in the bladder.

Location of Lesions.—In bladder tuberculosis, secondary to the kidney implication, the first evidence is seen around the orifice of the ureter; this extends either backward or upward, involving the posterior part of the trigone and the mucosa behind it. When the disease comes from the prostate, it implicates the trigone, the neck of the bladder and surrounding tissues. There are several instances to prove that a tuberculous kidney may give rise to infection only of the mucosa around the orifice of the ureter, then skip entirely the base of the bladder and infect the prostate. I have seen such a case, and Bandler and others have recorded similar observations.

In 83 cases of my series the lesions were localized as follows: In the trigone or near it, 27 times; in the orifice of the ureters or adjacent to their margins, 23 times; in the base of the bladder, by which is meant the region behind the trigone, 10 times; in the posterior wall, 7 times; in the anterior wall, 7 times; in the vesical neck, 7 times; in the superior portion of the bladder, twice.

Le Fur out of 60 cases in 12 found the lesions in the region of the ureteral openings; in 10 in the base; in 9 on the posterior wall; in 5 on the anterior wall; in 5 on the trigone; in 3 on the neck; in 3 on the neck and trigone.

Single ulcers limited to the anterior wall have been seen by Strauss and Jacquet.

Complications.—It is relatively rare for tuberculous ulcers to penetrate the bladder wall; when perforation occurs it is usually found in the base. I have observed two instances: One in the superior part of the bladder, which extended to the rectus muscle, with abscess formation; the other perforation had occurred through the trigone into the prostate.

Guon has reported a number of ulcerations through the base. Denzel found one which extended to a pocket behind the prostate. A similar instance was observed by Dittel. Muster, in a girl of 18, discovered a fistula from the bladder into

the vagina. Barlow noted a communication between the posterior urethra and rectum. Lichtwitz and Ungerer record fistulous openings from a tuberculous bladder into the groin. Bovis noted a tuberculous fistula which ran from the bladder to the umbilicus; it was thought that the urachus had not entirely closed and had been made larger by the tuberculous process. Denzel observed an aperture from the bladder into the peritoneum resulting in peritonitis and death. Hewett examined a perforation of the abdominal wall between the umbilicus and symphysis and another breach in the same bladder which joined it with the rectum. Bryson, Pousson, Lane, Marchand and Schücking have seen fistulous tracts between the bladder and the rectum. Englisch noted a connection of the bladder with the small intestine. Winckel, in a study of 2505 autopsies in the female, detected 4 tuberculous ulcers which had penetrated the bladder wall.

McCabe and Clado found diverticula in two cases; in the record of the former the sac was larger than the bladder.

Phosphatic concretions have been observed over the surface of tuberculous ulcers, and well-formed stones have been repeatedly found. Bocaloglu and Gleize report an instance in which a large stone had formed in a tuberculous bladder, ulcerated through the rectum, and presented itself at the anal orifice.

ASSOCIATION OF TUBERCULOSIS OF THE BLADDER WITH THAT OF THE OTHER GENITO-URINARY ORGANS.

In 411 cases out of a collected series of 447, the involvement of the other genito-urinary organs was specifically stated. The result is as follows:

Bladder and kidney.....	119
Bladder and prostate.....	33
Bladder, prostate and epididymis.....	30
Bladder, kidney and prostate.....	28
Bladder and epididymis.....	26
Bladder, kidney, prostate, vesicles and epididymis.....	26
Bladder, kidney, prostate and epididymis.....	24
Bladder, prostate, vesicles and epididymis.....	23
Bladder, kidney, prostate and vesicles.....	13
Bladder, tubes and uterus.....	12

Bladder, kidney and epididymis.....	11
Bladder, vesicles and epididymis.....	11
Bladder, prostate and vesicles.....	10
Bladder, kidney, vesicles and epididymis.....	7
Bladder and Fallopian tubes.....	6
Bladder and vesicles.....	6
Bladder, kidney, Fallopian tubes and uterus.....	4
Bladder, kidney, Fallopian tubes and ovaries.....	2
Bladder, kidney and ovaries.....	2
Bladder, kidney and tubes.....	2
Bladder, kidney and uterus.....	2
Bladder, tubes and ovaries.....	2
Bladder, tubes, ovaries, uterus and vagina.....	2
Bladder, tubes and vagina.....	2
Bladder, kidney, Cowper's gland and urethra.....	1
Bladder, kidney, tubes and vagina.....	1
Bladder, kidney and urethra.....	1
Bladder, kidney and vagina.....	1
Bladder, kidney and vesicles.....	1
Bladder, ovaries, uterus and vagina.....	1
Bladder and uterus.....	1
Bladder and vagina.....	1

In 22 instances of bladder tuberculosis in the Johns Hopkins Hospital Pathological Laboratory, the other genito-urinary organs affected were as follows:

Bladder, kidney, (8 with ureter).....	9
Bladder, kidney and epididymis.....	3
Bladder, kidney, prostate and epididymis.....	3
Bladder, kidney and prostate.....	3
Bladder, kidney and ovary.....	1
Bladder, kidney, prostate, vesicles and epididymis.....	1
Bladder, kidney and uterus.....	1
Bladder, prostate and epididymis.....	1

THE ASSOCIATION OF BLADDER TUBERCULOSIS WITH THAT OF OTHER SINGLE ORGANS.

Bladder and kidney.....	245
Bladder and prostate.....	187
Bladder and epididymis.....	158
Bladder and vesicles.....	97
Bladder and ureters.....	67
Bladder and tubes.....	33
Bladder and urethra (with prostate).....	31
Bladder and urethra (without prostate).....	7

Bladder and urethra (female).....	4
Bladder and uterus.....	22
Bladder and vasa deferentia.....	19
Bladder and ovaries.....	9
Bladder and vagina.....	8
Bladder and Cowper's gland.....	1
Bladder and lungs.....	134
Bladder and bone.....	15
Bladder and intestine.....	8
Bladder and liver.....	5
Bladder and peritoneum.....	4
Bladder and spleen.....	4

Primary Genito-Urinary Tuberculosis.—I have searched the histories carefully in order to determine in what number the tuberculosis had originated in the genito-urinary tract. I have taken for granted, when the lungs are said to have been healthy, and no mention is made of implication of any other organs that the disease was probably primary in the genito-urinary tract. I have presumed also that this was first involved, when the chief description was confined to it and no mention was made of tuberculosis in any other part of the body. According to the above explanation, I found 145 cases in which the process seems to have commenced in the genito-urinary tract. They are as follows:

Lungs stated to be negative.....	39
No mention of other organs.....	54
Primary in genito-urinary organs (stated).....	52

145

Secondary Genito-Urinary Tuberculosis.—In 122 cases the primary focus was mentioned, but in 17 not definitely stated.

Primary in lungs.....	74
Primary in bone and joints.....	15
Primary in glands of neck.....	7
Primary in pleura.....	7
Primary in skin.....	2
Primary focus indefinite.....	17

Order of the Invasion of the Genito-Urinary Organs.—In 279 instances there were sufficient data to enable one to

form an approximate idea as to the invasion. The kidney seemed to be first implicated in 184; the epididymis in 80; the prostate in 6; the fallopian tubes in 6; the seminal vesicles in 2; and the uterus in 1. In perhaps many more some portion of the genito-urinary tract was the primary seat of the tuberculosis, but the history was not given with sufficient clearness to afford certainty on this point.

From the above it is seen that the two organs from which the bladder is most frequently infected are the kidney and the epididymis, the former source supplying by far the larger number of cases. From the epididymis, the disease spreads along the vas and affects the seminal vesicles and prostate, later implicating the posterior urethra and bladder. The testicle, in contradistinction to the epididymis, is so exceptionally the primary seat of disease, that practically it need not be considered as a point of origin. In my opinion the prostate is not often primarily affected, but I would hasten to add that Koenig, Tuffier, Simmonds and Krzywicki are of the contrary opinion and hold that it frequently contains the initial focus. Heiberg in a series of 31 cases of secondary genito-urinary tuberculosis, found the process limited to the prostate in three instances; but in his primary series of 14, it was never affected alone. Krzywicki in 14 collected cases of tuberculosis of the prostate records two similar examples and Collinet has also described two.

That the vesicles may provide the genito-urinary source of origin of the disease is undoubted, but it is generally admitted that the invasion is usually secondary; a few instances of tuberculosis confined to them, however, have been observed by Oppenheim, Kocher, Orth and Dreyer.

ETIOLOGY.

The bladder is very resistant to tubercle bacilli and may withstand their continued presence for months or even years without becoming infected. This has been shown numbers of times in cases of tuberculosis of the kidney, in which the urine has been full of tubercle bacilli for months and yet the

bladder has remained entirely uninfected. Experimental work also abundantly proves this point.

The bladder is rarely affected primarily; the only exception is that recorded by Saxtorph, who in 10,016 general autopsies, in a single instance found the female bladder to contain the only focus of tuberculosis in the body. Heiberg observed at autopsy a tuberculous female bladder, the remaining genito-urinary organs being free; but in this case the process was secondary to an infection in the glands of the neck.

Clinically, primary bladder tuberculosis has been reported often, but as the pathology is being more carefully studied, we are becoming convinced that these reports were erroneous. I feel justified, therefore, in saying that while primary tuberculosis of the bladder is a possibility, for practical surgical consideration its existence may be disregarded.

Tuberculosis of the lungs and of bone seem to be more frequently followed by tuberculosis of the bladder than of any other organ. In 394 autopsies which showed disease of the lungs, there were 16 instances of implication of the bladder; 13 times in connection with chronic, and 3 times with general miliary tuberculosis. In 45 cases of bone tuberculosis the bladder was affected 4 times.

Experimental Work.—I have injected virulent tubercle bacilli into the bladders of a series of rabbits under different conditions; (1) into the normal bladder, (2) into that organ after having curetted the mucous membrane; in neither series have I been able to produce an infection. I have this work still in progress and will give a full report later.

Hanau introduced tubercle bacilli into the urethra of guinea-pigs and succeeded in inducing tuberculosis of the urethra and bladder.

Rovsing has demonstrated that tuberculosis of the bladder cannot be produced by injecting tubercle bacilli into it, even if they be allowed to remain 24 hours, but he did succeed after contusing the mucous membrane and keeping the organisms imprisoned for 20 hours.

Baumgarten caused a tuberculosis of the posterior urethra,

prostate and neck of the bladder in rabbits, by instilling the bacilli deeply into the urethra.

Hansen, in 16 cases of artificial tuberculosis of the kidney, had two in which infection of the bladder subsequently developed. In 7 other animals, he injured the mucous membrane of the bladder very extensively, and then injected tubercle bacilli; 4 of these experiments gave positive results.

Pyogenic Organisms.—It is impossible to state the exact influence which pyogenic cystitis exerts upon the infection from tubercle bacilli, but it is probable that such an inflammation lowers the resistance of the mucosa, and produces minute breaks in the surface, which allow the tubercle bacilli to enter the submucosa. On the other hand, the increased blood supply and the extensive infiltration of leukocytes and lymphoid cells, together with a possible inhibiting influence of the toxins of certain pyogenic bacteria, may offer definite resistance to the tuberculous invasion.

The inhibition of pyogenic toxins just mentioned has not been proved and may not exist at all, for we see many specimens from kidneys, bladders, intestines and other organs in which pyogenic bacteria and tubercle bacilli have grown together on apparently very friendly terms. Nevertheless, it would seem that a cystitis caused by members of the proteus group or certain varieties of the colon bacilli does not offer so fertile a field for the invasion of tubercle bacilli as that produced by streptococci and gonococci. These last two organisms unquestionably are good forerunners for tuberculosis.

It can be stated, however, that in no case of cystitis, be it ever so bad, does the bladder ever become infected with tubercle bacilli even if tuberculosis of the lungs, bone or other part, exists, unless some other portion of the genito-urinary tract is implicated.

In this connection it must be insisted that all patients who have any focus of tuberculosis in the genito-urinary organs should be protected as far as possible from anything which might give rise to a cystitis, and that when such does occur it should receive more than ordinarily careful treatment.

Gonococci.—The question as to the predisposing influence of gonorrhœal inflammation is not definitely decided, but in view of the fact that a number of cases of bladder tuberculosis have followed closely upon acute gonorrhœal urethritis and cystitis, it would seem highly probable that an attack of gonorrhœa occurring in individuals suffering from tuberculosis of the kidneys or epididymes may favor the development of a bladder tuberculosis. It must be stated, however, that about 85 per cent. of adult males, and a fairly large proportion of adult females, have had a gonorrhœa at some time during their lives, so that the relationship is possibly more co-incidental than real.

In 135 cases of my collected series, gonorrhœa was stated to have been present in 71 and denied in 64. In a few the tuberculosis followed the acute attack, but in most of them it was remote.

Casper saw two instances of bladder tuberculosis develop immediately after an attack of acute gonorrhœa; so far as he could discover there had been no tuberculous focus in the body before and Casper thought that the tubercle bacilli had been directly implanted on the injured mucosa. How they gained entrance he does not state. Such a conclusion is certainly open to question.

Cornil, Babès, Motz, Hallé and Bloodgood have found gonococci and tubercle bacilli associated in the urine. Routier and Holländer have reported a cystitis which followed an acute gonorrhœa and which later was proved to be tuberculous.

Loomis, in a patient who had had for some time a cough and occasional pain in the region of the kidney, observed frequent and painful micturition following an acute gonorrhœa; the process proved to be tuberculous and ran a rapidly fatal course. It is probable that the patient had a primary disease of the kidney and that the gonorrhœa caused the bladder to become affected, thus increasing the rapidity of the whole process.

Sexual Intercourse.—It is possible that either the male or the female may become infected during coitus, but such an

occurrence is extremely rare, and the few instances which have been reported are open to doubt. If such an infection does occur, it is more likely to happen to the female, the tuberculous semen being deposited in the vagina and remaining for several days in contact with the cervix or making its way into the uterus.

Greize reports the case of a male of 37, who was thought to have been infected by a woman suffering from tuberculosis of the cervix. Gracienescu mentions the case of a female who, after cohabitation with a man suffering from local tuberculosis, developed the disease.

Schüchardt believes in the danger, and has observed a tuberculous ulcer develop on the glans penis after intercourse. In another instance he examined a female who had a very severe and acute inflammation of the vagina, the secretions from which showed gonococci and tubercle bacilli; this condition had developed after intercourse with a tuberculous male. In this connection, it is interesting to note that tubercle bacilli have been found, by Jani and Nakarai, in normal prostates and testicles of individuals suffering from pulmonary tuberculosis. The virulence of these bacilli was proved by Nakari, who inoculated them into animals. The germs may thus be present in the semen, in the absence of lesions of the genital organs, but these organisms must of necessity be few and can play no role as infective agents.

Instrumentation.—In individuals suffering from tuberculosis of the kidney, prostate or epididymis, the insertion of metal instruments, or stiff catheters, may wound the vesical neck or bladder mucosa, and afford a starting point for a bladder tuberculosis. It behooves us, therefore, in all cases of this kind to limit their introduction and, when indispensable, to practise the procedure only with extreme care and delicacy.

Means of Infection.—Theoretically the bladder may become infected by the blood or lymph, but since it is so rarely involved alone and since even in general miliary tuberculosis miliary tubercles in the bladder are very seldom found, much doubt is thrown upon the occurrence of infection through these channels.

A case occurring in the Johns Hopkins Hospital, in which some of the physicians thought that implication of the bladder had occurred in this way, may be cited as an example. The patient had had no bladder disturbance, nor change of urine during life; at the autopsy there were discovered two gray tubercles (miliary) in the trigone, and a few in both kidneys, the other genito-urinary organs being free. Here there is a possibility, of course, that the tubercle bacilli may have been conveyed to the bladder by the blood or lymph; but on the other hand, they most certainly could have come down from the kidneys.

The two principal modes of infection then, are: First, from the kidney above, and second, from the epididymes, prostate and vesicles below. The tubercle bacilli from the kidney enter the bladder in two ways: (1) They may pass by direct extension from the mucous membrane of the ureter to that of the bladder; (2) they may be brought down in the urine, and enter the submucosa through some microscopic fissure. From the prostate below, they either enter by direct invasion through the base of the bladder, or implicate first the prostatic urethra and then the bladder mucosa.

Extension from the peritoneum directly through the bladder wall is spoken of as a possibility, but there are no undoubted observations to confirm it. I have been unable to find any evidence of such a penetration in the specimens which I have examined.

It is thought to be possible by some observers that the disease may extend from the rectum into the bladder; such an occurrence I have found neither in the literature nor in my personal experience.

Traumatism.—Trauma of one kind or another may prove a predisposing factor, but there are no recorded instances to substantiate this opinion.

Diseases of the Urethra.—In cases of genito-urinary tuberculosis, inflammatory thickening, particularly when it gives rise to the formation of stricture, seems to be a predisposing factor in inciting the development of bladder tuberculosis.

Crismore, Motz, Hallé, and others have reported instances in which the stricture had a very baneful influence. Jamin observed a lighting up of a very severe cystitis, presumably tuberculous, after dilatation of a urethral stricture.

Stone has been found not infrequently associated with bladder tuberculosis. In some subjects it has preceded the development of the disease several years. Bacaloglu and Gleize report the case of a patient who had suffered a long time from attacks of cystitis which alternated with periods of improvement; these attacks gradually became worse, and at the operation a stone the size of a pigeon's egg, weighing 25 grammes, was removed; some time later tubercle bacilli were discovered in the urine, and tuberculosis of the epididymes and prostate developed.

Carleton observed a man who had complained for a long time of symptoms of bladder stone. At the operation a large calculus was found and the bladder mucous membrane was tuberculous.

In the Johns Hopkins Hospital there were about thirty small stones removed from a tuberculous bladder; calculi continued to form for several months and were taken out from time to time.

Heredity.—There were 100 cases in which were recorded notes as to the presence or absence of tuberculosis in the family; 55 patients acknowledged that some member had suffered from the disease, 45 denied it. It is probable that the hereditary tendency (as now understood) plays the same part in tuberculosis of the genito-urinary organs as it does in other parts of the body.

Habits.—The records were not full enough for me to determine whether the use of alcohol, excessive sexual indulgence, and other forms of dissipation acted as predisposing agents; my own opinion, however, is that a virtuous life does not materially lessen the chances of infection of these organs by tuberculosis.

Professions, Trades, Etc.—Accurate statistics in regard to this point were not forthcoming, but I feel sure that the

larger proportion of cases of genito-urinary tuberculosis will be found among laborers and those who have been compelled to lead lives of exposure and hardship.

Sex.—Of 438 patients of whom the sex was given, there were 285 males and 153 females. The statement of some observers that the disease is quite as common in females as in males—perhaps even more common—must certainly be incorrect, because in the male there are additional sources of infection—epididymes, prostate, vesicles, to which in the female there are no organs that are analogous in this connection. Indeed, in the female the kidney is practically the only source of infection. In order, however, to be entirely just, I will state that in this study I have been particularly interested in male tuberculosis and possibly may unintentionally have overlooked some females.

Age.—The youngest patient (condition found at autopsy) was a child of two years (Peroud); the oldest was a man of 97 (Tapret). Ammond's patient was a child of $3\frac{1}{2}$ years; Horwitz's 3 years; West's 4 years; Moullin had one of 4 years, and a man of 70 years of age. The age according to decades is as follows:

IN THE MALE:		IN THE FEMALE:	
I to 10	4	I to 10	2
11 to 20	32	11 to 20	20
21 to 30	94	21 to 30	37
31 to 40	70	31 to 40	26
41 to 50	50	41 to 50	11
51 to 60	14	51 to 60	2
61 to 70	6	61 to 70	5
71 to 80	0	71 to 80	1
81 to 90	0	81 to 90	0
91 to 100	1	91 to 100	0
<hr/>		<hr/>	
271		104	

The average age in females as obtained from 104 cases is 37.78 years; the average age in males in 271 cases is 33.26 years.

SYMPTOMATOLOGY AND DIAGNOSTIC DATA.

THERE is no one sign nor symptom, nor is there a definite symptom-complex which indubitably proves the presence of tuberculosis of the bladder. Direct inspection only can justify an absolute diagnosis. The same frequent and painful micturition and the general bladder distress which accompanies tuberculosis of that organ is also produced to nearly the same degree of intensity by tuberculosis of the kidney, and almost the same symptomatic picture is presented by certain cases of tuberculosis of the prostate. This fact has been proved often by autopsies and cystoscopic examinations. A very interesting example has been recorded by Keys, in which a patient was compelled to urinate every 5 or 10 minutes, and yet at autopsy there was disclosed no implication of the bladder.

The localized symptoms most generally met with are frequent and painful micturition, a dull aching sensation in the pelvis, and the presence of pus, tubercle bacilli and blood in the urine. The general symptoms are a gradual loss of flesh, an increasing anæmia, an irregular temperature, occasional chills, etc.

It should be stated, however, that tuberculosis of the bladder rarely presents a picture entirely due to the disease of that viscus, for the reason that some one or the other genito-urinary organs is generally implicated.

Frequency and pain with micturition will be discussed first together, because they are so often associated, and then singly.

In 294 reports in which the symptoms were given, there were 201 which gave this as a prominent complaint in some stage of the disease. In a number of others, it was not specifically stated that pain and frequency of micturition were met with together, but from other signs present, it is presumable that such was the case; if such cases are added to the above list, the proportion would be much larger, so that I do not think I should err in saying that over 95 per cent. present the combination of frequency and pain with micturition. This complex sometimes occurs at intervals, remains for a few days

or even several weeks, and then passes off almost entirely for a variable period, such free intervals and recrudescences covering several years. This type is exceptional, the general rule is a steadily downward progress, the pain becoming greater and micturition more frequent.

As an example of the above, one of my patients twelve years ago had an attack of cystitis (with frequent and painful micturition), which lasted for three days; this entirely disappeared and there was no further trouble for three years, when a second attack occurred. This was soon followed by others, and after a while the intervals became shorter and shorter until finally the suffering became continuous.

Frequency of Micturition.—In the very beginning, there is an augmentation in the quantity passed, but no change in the frequency of urination. Soon there is noted an increase in the number of times during the day, and the patient, who has before slept all night, is now forced to get up once or twice. This frequency gradually increases as the disease progresses and is accompanied by burning and pain. The intervals become shorter and shorter, the average in the later stages being from 20 to 30 minutes; in the more extreme cases, micturition occurs every 5 to 10 minutes during the day and night. Basset and Perkins observed a case in which the patient passed water every 5 minutes; Routier recorded an instance of 40 micturitions during the day and the same number during the night. One of my patients had 27 calls during the daytime. In women it is sometimes necessary to wear a napkin.

This symptom is neither relieved by rest nor increased by exercise, nor is it diminished to any extent at night. The underlying cause of frequent urination in bladder tuberculosis is the irritation of the vesical neck and floor of the prostatic urethra by the morbid process. This renders the nerve endings which normally control the phenomenon of micturition much more easily impressed; consequently the bladder becomes intolerant of much fluid. In the bladders which show an implication of the superior half, with a comparatively free base, frequent micturition is not prominent.

Pain.—At the very first pain is usually absent. As the disease advances, it becomes more and more in evidence, and toward the last stage is sometimes intolerable; it is described as dull, aching, occasionally sharp or lancinating; it is felt at the beginning of, during, or at the end of micturition; most frequently, however, pain accompanies the whole act, with an exacerbation at the end. It may be transmitted all along the urethra, or confined to the prostatic portion, and in a few patients it is felt only in the glans penis. After micturition it continues for several minutes, but is not acute, the patients describing it as a dragging, burning sensation. It is usually associated with frequency, but to this there are a few exceptions. In two cases in the Johns Hopkins Hospital, there was marked frequency but no pain. Guyon and others have noted similar instances. In a few the pain was the initial symptom and remained for some time before any other bladder disturbance was noted. It is transmitted occasionally to the perineum, to the suprapubic region, down the legs, and to the renal region; sometimes the pain is continuously present and is of a very sharp neuralgic type, extending over the whole back.

The pain is produced by the ulceration and tuberculous process in and near the vesical neck, and is intensified by the contraction of the bladder during and after micturition. When only the superior half of the organ is affected the pain is very much less and may be altogether absent.

Changes in the Urine.—It is difficult to state the exact alterations in the urine caused by bladder tuberculosis, for the reason that this process is usually complicated by tuberculosis of the kidney or prostate. Given then, an unusual condition in which the bladder has become infected from the epididymes, prostate, or vesicles, and where the focus does not communicate with the urethra, the very first change would be an increased secretion of urine due to excitation of the kidneys. Following very soon upon this augmentation in the urine, pus and exfoliated bladder epithelial cells appear, along with a few red corpuscles and possibly some tubercle bacilli. As the disease advances the pus becomes much greater in quantity, the blood

is more in evidence, and the tubercle bacilli are more readily demonstrated. Still later, in the stage of ulceration, there is added to the above debris consisting of necrotic and cheesy material.

The reaction in the majority of urines is acid: in 46 recorded analyses, 28 urines were acid, 14 were alkaline, 3 were ammoniacal, and 1 was neutral. The average specific gravity was 1018; the lowest was 1006, and the highest was 1022. The urea varied from 8 to 13 grammes per litre. The phosphoric acid (P_2O_5) ranged about 0.65. The chlorides, according to a late investigation by Bignon are usually increased, particularly when the kidney is involved. There is no reason for any alteration of the chemical constituents of the urine in tuberculosis of the bladder except as a result of reflex stimulation of the kidney; the real deviation from normal in this respect is induced by disease of the kidney.

Blood.—Hæmaturia is not so infrequently the first symptom, and may be present at intervals for a number of years, before any bladder distress or other signs show themselves.

In 146 cases bleeding was noted at some stage of the disease, in 20 it was an initial symptom. There is no absolutely characteristic sign which under all conditions will enable us to differentiate between blood from the kidney and blood from the bladder, except the evidence of cystoscopic examination. Usually the blood coming with the last portion of urine, or at the end of micturition, signifies that either the bladder or vesical neck is its source; homogenous red urine may indicate bleeding either from the bladder or kidney; if it comes from the bladder it means that there is an extensive process of some kind present; if this can be reasonably excluded, the bleeding is presumably renal in origin.

The periods of bleeding vary in duration from a few hours to several weeks and occur at intervals of weeks, months, or even years; they are most frequently met with in the first stage of the disease and tend to diminish toward the end; the quantity of blood lost, as a rule, is small; sometimes, however, it is large, and exceptionally it has been sufficient to endanger life.

Clado observed a patient who bled continuously for 1½ years. Pierchon cites an initial symptom of profuse bleeding which was prolonged for several weeks. Raymond had a patient who suffered from bleeding at intervals for 7 years before bladder distress developed. Casper's patient had had hæmaturia for 5 years prior to the appearance of any other sign of tuberculosis. In one of Raillaird's cases there was paroxysmal hæmaturia for eighteen years; in one of Talayrach's for three years. Horwitz observed one case in which bleeding occurred at intervals for three years before the cystitis began. These were all probably instances of primary renal tuberculosis.

The hæmaturia is caused in two ways. First, in the earlier stages, when there is much congestion and some ulceration, the blood is squeezed out by the contractions of the bladder; secondly, later when the ulceration is more extensive, the blood vessels may become eroded and the blood be poured out in larger quantity.

Tubercle Bacilli.—These organisms were frequently reported as absent; this I take to be the result of inadequate examinations, for a careful search will always reveal them. They were recorded as present in 110 cases—in a little over 50 per cent. of the histories in which the results of an examination were given.

The presence of tubercle bacilli in the urine does not always mean that tuberculous lesions are present in the bladder, for it has been proved that they may be excreted by the kidney and appear in the urine in the absence of any disease of the urinary tract. Israel on two occasions found them in the urine of a patient who at autopsy showed a complete absence of genito-urinary tuberculosis. Thilicwicz disclosed their presence in the urine in a case of miliary tuberculosis which at autopsy showed no local lesions. The observations of Jani and Nakarai have already been mentioned.

Pyogenic Organisms.—The most common secondary bacteria present in the urine, as before stated, are colon bacilli, diplococci, streptococci, and members of the proteus group.

These, particularly colon bacilli, are usually present in the terminal stages. Members of the proteus group are seen in the ammoniacal and occasionally in other alkaline urines. Gonococci have been demonstrated a few times.

The total quantity of urine passed in the twenty-four hours varies with each individual case, but is liable to be somewhat above normal. The smallest quantity, 800 cc., was observed by Battle in a ten-year-old girl; the largest amount, 2500 cc., occurred in a male of 47 (Bignon); the average quantity was 1660 cc. Sondern in 74 cases found the average to be 1430; the largest was 2200 cc. and the smallest was 720 cc.

The capacity of the bladder is diminished. This as demonstrated in 41 cases averaged 97 cc.; the smallest was 20 cc. (Catron) and the largest was 420 cc.; of these 41 bladders, 27 had a capacity of under 100 cc.

Cystoscopic Examination.—In the bladders which have been infected from the kidney, we see on the corresponding side on cystoscopic inspection an irregular ureteral orifice with some swelling and redness on the edges and a slight congestion of the surrounding mucous membrane, with the occasional presence of a few reddish papules. This picture does not represent a true tuberculosis, but is rather that of irritation produced by the tuberculous toxins. Later there is seen an increase in the red zone and the formation of definite tubercles which appear as fine gray points with a faint reddish zone surrounding them. In a short time this picture is succeeded by another, which shows a development of more tubercles, with an aggregation, coalescence, and secondary loss of substance, and the consequent formation of one or more minute ulcers. The mucous membrane in this stage is otherwise normal, except for a slight congestion in the trigone and vesical neck. A still later examination discloses an extension of the ulceration toward the trigone, or upward and backward on the posterior and lateral surfaces. Following this increased ulceration, the whole mucosa not infrequently becomes injected and slightly swollen, and presents the picture of a cystitis; this is particularly true when there has been a secondary invasion. In the

last stages there is a very extensive ulceration of most of the mucous membrane and in many places an exposure of the muscular coat.

When the disease comes up from the prostate, nearly the same picture is presented with the exception of the above mentioned initial and probably non-tuberculous stage; the lesions, of course, are differently located, being near the vesical neck and in the trigone. In this type there seems to be a more rapid development of tubercles, with an earlier breaking down and ulceration, the more rapid course being probably due to the situation of the lesions which are thus subjected to more irritation from the contractions of the bladder.

Tuberculous Ulcer.—The outline is irregular; there is a general tendency toward a circular form with irregular projections; the edges are ragged, red, swollen, slightly indurated, and overhanging; the base is covered with an uneven, very delicate granulation tissue, over which are scattered yellow and gray flakes of fibrin. The mucous membrane immediately surrounding the ulcer is diffusely reddened and no individual blood vessels can be seen; outside of this is a less reddened zone, where they are more distinct. The ulcer varies in depth; usually it does not penetrate farther than the submucosa tissue, but occasionally it passes through this and exposes the muscle, which in turn it erodes.

According to descriptions found in the literature, the ulceration in a majority of instances begins in the region of the ureter; the individual ulcers range in size from that of a pin-head up to that of a silver dollar; usually several are present, but single ones have been noted by Strauss, Reynès and Battle.

Unusual Conditions.—Stoeckel observed a bladder whose base was covered with polypoid excrescences; these were very small, and for the most part were translucent; some of them were slightly reddened; there were no tubercles, no ulcers; tubercle bacilli were not found at first, but were discovered later. Mirabeau has made a similar observation in a case which also proved to be tuberculous.

Malherbe saw a brownish mass which at first was taken for a tumor, but later at operation was shown to be a tuberculous process.

Incontinence.—Three kinds of incontinence are met with: (1) The true form which is brought about by the destruction of the vesical neck; (2) that of dribbling from over-distention; (3) that caused by an exaggerated and imperious desire to micturate. True incontinence is observed only in the last stages, when the disease has become extensive, infiltrative and destructive. The over-distention type is produced either by some obstruction in the prostatic region, or by grave implication of the muscle which weakens it and allows the bladder to distend. In the last form the urine begins to flow as soon as the desire is felt.

Retention of urine is sometimes seen. It occasionally appears very early, and the first thing that draws the attention of the patient to any abnormal state is that he suddenly becomes unable to urinate and is compelled to have recourse to a catheter. Retention is brought about in four ways: (1) By irritation around the vesical neck which produces a spasmodic constriction; (2) by the implication of the prostate or the swelling of the tissues around the neck of the bladder which forms an obstruction; (3) by hindrance of the outflow by a blood-clot; (4) by more or less complete destruction of the muscle wall of the bladder which so weakens it that the viscus has not sufficient force to expel the urine.

Tuberculosis of the Bladder Without Symptoms During Life.—Every now and then one finds at autopsy a more or less extensive disease of the bladder which has produced no symptoms before death. In such instances it is usually the superior half of the viscus which has been invaded.

Stein saw at autopsy a number of ulcerations at the summit of the bladder, the patient having complained of no disturbance of micturition. Kidd observed a very extensive ulceration of the mucous membrane, which had caused no bladder distress. Smith saw a single ulcer which was not known to have caused any discomfort before death. In three

patients in the Johns Hopkins Hospital there had been no trouble with the bladder, but at autopsy lesions were found; in the first there was a decided implication of the mucous membrane; in the other two there were several fine gray tubercles in the trigone.

Loss of Flesh.—In the early stages of bladder tuberculosis, the patient retains his weight to a remarkable degree and occasionally gains from time to time; it is the rule, however, in the latter half to have loss of flesh, which in the terminal stages becomes rapid. This cannot all be ascribed to the disease of the bladder, for there are other tuberculous foci present which are preying upon the patient. Again, the emaciation is in part directly due to exhaustion and loss of sleep, caused by the frequent and painful micturition.

Anæmia.—A certain degree of pallor is observed very early, although some persons retain their color for a long time; later the anæmia is very pronounced and the blood presents the same changes as in tuberculosis of other organs.

Fever.—This is a late symptom, is of irregular type and ranges from 99° to 103° F. Chilly sensations and occasionally definite rigors precede the rise in temperature.

Pulse.—The pulse sympathizes with the general weakness and the temperature.

Complications.—The main complications are infection by pyogenic organisms, stone, stricture, and prostatic abscess. Secondarily, of course, we may have those following perforation of the ulcer into the surrounding structures. Infection by pyogenic bacteria and the presence of stone have been discussed already. Stricture has been observed several times in this connection, and often aggravates the other symptoms and increases the rapidity of the course of the disease. Typical instances have been recorded by Motz, Crismore, and others. Prostatic abscess often complicates tuberculosis of the bladder; it produces retention, great increase in the pain, local swelling and discomfort in the perineum. Perforation into the large or small intestine, may allow all the water to be discharged into the bowel, greatly increases the suffering, and hastens the

end. Perforation into the peritoneum produces peritonitis and death. Opening into the perineum, behind the prostate, or into the suprapubic region gives rise to abscess formation with its consequent train of symptoms.

Duration of Symptoms.—Inasmuch as bladder tuberculosis in every instance is complicated by other conditions, such as tuberculosis of the kidney or prostate, primary stone and primary simple cystitis, it is impossible to state with precision how long tuberculosis of the bladder had been present in the cases which I have analyzed. In the following calculation I have estimated the time from the date of the first symptoms up to the time at which the patient first came under the observation of the recorder of the case. This method must of necessity be inaccurate, for the records are indefinite—for instance, the following phrases are used: “Blood at intervals for 5 years, later painful and frequent micturition;” “Cystitis to some extent for 10 years, several years later increased frequency with pain;” “Symptoms of stone for 4 years; then tuberculosis developed.” Such cases may or may not have been tuberculous from the beginning; possibly in some the process at first was simple and a tuberculous infection occurred only later. With the above explanation, I will state that I have computed the time in 172 cases, and find that the average duration of the bladder tuberculosis from the beginning up to the date of the history is 25.21 months. The shortest time was 14 days and the longest 11 years. The duration of symptoms from the beginning to the time of death, as calculated from the histories in which the dates were given, is 35.05 months, or in round numbers 3 years.

(To be continued.)

RECURRENT INTERMITTENT RETENTION OF
URINE OCCURRING WITH THE REMISSIONS
IN A CASE OF PERNICIOUS ANÆMIA—THE
FINAL RESULT OF A BOTTINI OPERATION
FOR ASSOCIATED PROSTATIC HYPERTROPHY.

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THE interest in this case is the recurrent intermittent retention of urine dependent upon remissions or exacerbations of anæmia in the course of a pernicious anæmia.

The purpose of this report is not to arrive at any definite conclusions, but to place on record an etiological factor producing intermittent retention of urine not heretofore mentioned, so far as the writer is aware. The case also illustrates the sequelæ of urinary retention; the benefit derived from a Bottini operation and the condition of the prostate three years following such an operation.

The changes in the blood during the course of the case are also of interest.

Male; widower; 47 years old; a native of New Brunswick; a teamster by occupation; entered the Boston City Hospital in the medical service of Dr. Henry Jackson, March 18, 1903. I wish to express my appreciation to this gentleman for the privilege of using the notes of this case while on his service.

Family History.—Father died of cancer of the throat; mother and wife with pneumonia; one child with tubercular meningitis. Two children living and well. No brothers or sisters.

Past History.—Measles in childhood. Otherwise always well. Denies venereal.

Habits.—Moderate use of tea, liquor and tobacco.

Present Illness.—For the past few weeks the patient has been unable to work on account of the fact that he becomes tired very easily. Headache has been a constant symptom, most

marked during the day. He becomes dizzy and gets out of breath on slight exertion. During the past week he has had difficulty in distinguishing objects, both far and near. During the past few weeks his appetite has been very poor and there has been a constant diarrhœa, not containing blood. Does not vomit. No cough. He has had several attacks of "palpitation of the heart," at which time he has felt dizzy and has been obliged to sit down. These attacks have lasted but a few moments, and have occurred after exertion.

There has been a gradually increasing frequency of micturition during the past five years, and four years ago he had complete retention, at which time he had to be catheterized regularly for three months. When he was not catheterized the urine dribbled away, but he was unable to pass any voluntarily. The patient states that he now passes his water six or seven times during the night and every hour or two during the day; that there has been increasing difficulty in starting the urine; that it comes slowly and drops directly from the meatus; and that dribbling follows the act. He states that the urine is cloudy and that a sediment settles to the bottom of the vessel. There has been no pain associated with urination, and he has never passed blood.

The patient states that he has not lost much weight. His chief complaint is weakness, headache, vertigo, and a difficulty in urination.

Physical Examination.—A well developed and nourished man with a yellowish pallor. Eyes: pupils, motions, and reactions normal, no arcus senilis; conjunctivæ, pale. Tongue: thick white coat, pale in color. Throat: very pale. Pulse: equal, regular, fair volume and tension. Heart: right border two fingerbreadths to right of sternum; left border in nipple line; apex in fifth interspace, nipple line; upper border, third rib; action regular; a soft blowing systolic murmur is heard at the apex and is transmitted into the axilla; the aortic second sound is accentuated. Lungs: good resonance, but numerous, sonorous, sibilant, and medium moist râles are heard throughout both chests. Liver dulness extends from the sixth rib to costal margin; edge not felt. Abdomen full, lax and tympanitic, not tender. In the hypogastrium a rounded tumor is palpable, extending half way to the umbilicus, which mass resembles a partially distended

bladder, both by palpitation and percussion. Extremities: moderate cedema about both ankles. Knee jerks and planter reflexes slightly increased. No glandular enlargement. There is a small inguinal hernia on both sides.

Rectal Examination.—Right lobe of the prostate slightly larger than the left. The median raphe is forced toward the left, the left lobe being normal in size. Both lobes smooth and of normal consistency, but the right lobe is rather less sensitive than the left. Both seminal vesicles are normal. Small external hæmorrhoids are present.

The urethra not instrumented. Temperature, 99°; pulse, 104.

Urine Examination.—Pale and turbid; sp. gr., 1005; alkaline; a trace of albumin; no bile or sugar; urea, .78. Moderate amount of sediment, which shows pus and squamous epithelium. No renal elements or crystals.

Blood Examination.—Leukocytes, 6000; red cells, 1,625,000; Hgb. 25 per cent.; marked poikilocytosis, macrocytosis and polychromatophilia. A differential count shows: Neutrophiles, 79 per cent.; basophiles, 19 per cent.; eosinophiles, 2 per cent. Three megaloblasts. One mast cell.

The patient was given Fowler's solution, iron preparations, and urotropine. He continued to run a temperature about normal and a pulse around 100.

Blood Examination.—Three days following entrance: Leukocytes, 8000; red cells, 1,200,000; Hgb., 15 per cent. Marked macro-, micro- and poikilocytosis and polychromatophilia; twelve megaloblasts and four normoblasts.

Five days following admission the patient complained that he was unable to pass any water. A tumor was evident over the pubes extending to the umbilicus and urine was issuing from the meatus in drops.

Urethral Examination.—A bougie à boule, No. 28 Fr. was passed to the anterior layer of the triangular ligament and withdrawn without meeting obstruction. A soft rubber catheter, No. 12 Fr., could not be passed into the prostatic urethra. A coudé, No. 12 Fr., was passed into the prostatic urethra, where it deviated about 30 degrees to the left during its passage through this portion of the urethra. Forty-five ounces of urine were withdrawn, and no hæmorrhage resulted. The coudé was tied in

position and siphon drainage established. The bladder drained well for four days, and was irrigated daily with a 4 per cent. boric acid solution, the twenty-four hours' amount of urine ranging between 38 and 45 ounces.

The examinations of the urine made were as at entrance. After the bladder had been drained for four days the catheter was removed because it became plugged with sediment. Following the patient was able to pass but a very small amount of urine at a time, and the bladder was constantly overflowing. A residual urine of 38 to 42 ounces was found at several different times.

The patient's chief complaint after being in the hospital one week was the retention of urine, and it was believed that the obstruction was due to prostatic hypertrophy.

Fourteen days after admission a cystoscopic examination was performed by the writer through the courtesy of Dr. Henry Jackson and Dr. Abner Post.

Cystoscopic Examination.—A soft rubber catheter, No. 12 Fr., was passed into the bladder, meeting obstruction in the prostatic urethra; 800 cc. of dirty urine withdrawn; bladder cleaned in about twenty minutes; bladder capacity, 850 cc.

The deep urethra and bladder were cocainized by an ounce of a 4 per cent. solution; 250 cc. of sterile water was introduced as an examining medium.

A simple concave, indirect cystoscope was introduced easily to the apex of the prostate. When forced into the prostatic urethra, it met obstruction and the beak deflected to the patient's left to about 30 degrees, and remained so during its passage through the prostatic urethra into the bladder. The bladder wall showed large roughæ deeply injected with many flacks of adherent fibrine (*chronic cystitis*). The trigone was distinct, and also deeply injected. Both urethral orifices were found with an areola of dark congestion about them. They were normal in size and functioning at a normal rate. The urine ejaculated was clear. The vesical surface of the prostate showed two distinct clefts to the right of the median line. (See Fig. 1.)

There was slight intravesical projection of the right lobe. No growths or foreign bodies seen.

Bimanual examination performed with the cystoscope in the bladder and the finger in the rectum. The prostate showed the right lobe to be slightly larger than the left. The consistency

rather firmer than normal. The left lobe normal in size and consistency. The surfaces of both smooth. The bladder wall is slightly thickened. The prostatic tissue posterior to the urethra not more than 1.5 cm. Tissue to the right of the prostate urethra over 3 cm.

Rotation of the beak over the vesical surface showed the right lobe to project about 2 cm. above the vesical orifice. The elevation was gradual in its decline anteriorly and posteriorly.

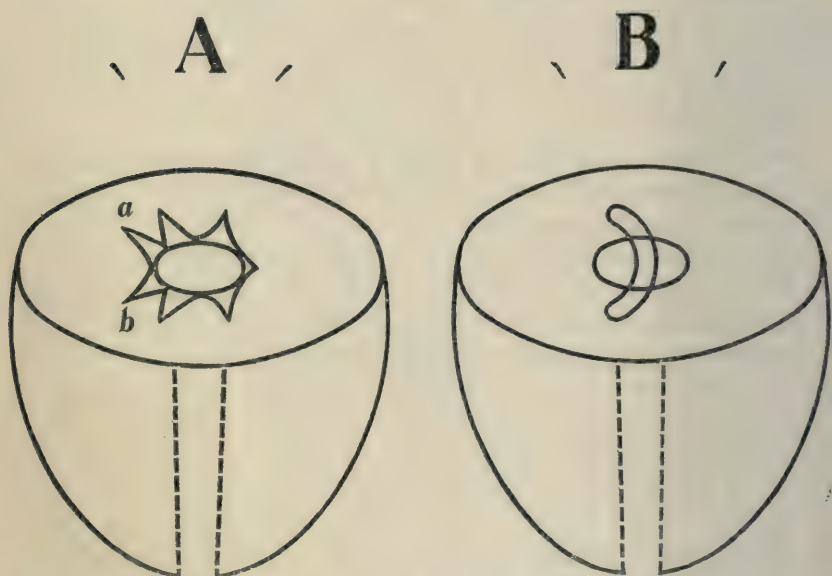


FIG. 1A.—Diagrammatic record of the cystoscopic fields at the vesical outlet, showing two clefts, *a*, *b*, a short distance to the right of a median line.

B.—The actual shape of the vesical orifice determined by transposing the inverted cystoscopic pictures recorded in A, showing the incroachment of the right lobe upon the urethra, deviating it to the left, narrowing it laterally and lengthening it antro-posteriorly.

The prostatic urethra was but slightly lengthened. In withdrawing the instrument the beak was rotated about 30 degrees to the left, where it remained during its withdrawal through the prostatic urethra. The passage was even and the resistance continual.

Part of the distending medium was passed voluntarily by the patient immediately after examination. It contained no blood, but was slightly turbid.

The patient voided his urine rather better for three days following the cystoscopic examination, as is so often the case,

but at the catheterization which was practised night and morning, the residual urine ranged between 28 and 36 ounces, and without the catheterization, the bladder became overdistended and dribbled constantly. The anæmia continued about the same, the patient's general condition not being improved.

Bottini operation, twelve days following the cystoscopic examination, performed through the courtesy of Dr. Henry Jackson and Dr. Abner Post.

The operation was performed under local cocaine anæsthesia. The 1.2 cm. blade was used. The right lateral lobe was incised at a mid-point for a distance of 1.75 cm. at the rate of one minute to the cm. out, and 30 seconds of the first cm. back, and one minute on the last .75 cm.

There was no pain during the operation except at the last .25 cm. going back. The cautery blade could not be heated beyond a dull red heat, because of some defect in the electrical connections.

It was originally intended to make two other incisions in the right lateral lobe, one on either side of the median incision. The operation was considered to be incomplete, and the patient was returned to the ward with the idea of repeating the procedure when the electrical apparatus was repaired.

Following Operation.—No suppression followed. The patient began to void his urine voluntarily. The urine was voided in three- or four-ounce amounts at short intervals. The urine contained considerable blood and bits of sloughing tissue for about a week. These gradually disappeared.

Ten days following operation, the patient was catheterized for the first time, and a residual urine of 12 ounces was obtained. A soft rubber catheter, No. 18 Fr., was passed without difficulty. There was so much improvement in the patient's condition that further operative procedure did not seem advisable at that time.

The residual urine was tested every three days, and five weeks after operation was reduced to 6 ounces. The patient held the urine at longer intervals, from three to four hours, and passed it but twice during the night. The urine started easily, and passed freely, but the dribbling after urination persisted. Examination of the urine was not different from that at the time of admission, except that the sediment contained a small amount of detritus, and a few blood corpuscles.

Blood examination at this date, five weeks after operation, was: Leukocytes, 5,622; red cells, 1,340,000; Hgb., 25 per cent.

The patient had gained considerably in strength, despite the fact that the blood examination was not materially changed during his stay in the hospital.

The improvement in the function of urination seemed to relieve the patient of most of his symptoms except weakness, and he desired to be discharged from the hospital.

The cystoscopic examination at this time, six weeks following operation, was as follows:

Cystoscopic Examination.—The bladder was entered with a soft rubber catheter, No. 18 Fr. The residual urine was 3 ounces; urine nearly clear; bladder washed clean in two minutes; bladder capacity, 400 cc.; 320 cc. of sterile water as examining medium. A simple, concave, indirect cystoscope passed without difficulty into the prostatic urethra, through which it passed with a deviation of about 10 degrees to the patient's left. The bladder rugæ distinct, but small, partially perhaps because of the large degree of distension by the examining fluid. The bladder wall was slightly injected everywhere; trigone distinct and but slightly injected. Both uretral orifices normal in appearance. The urine ejaculated clear. The vesical surface of the prostate as in Fig. 2. The right lobe, the one which was incised, shows a concavity which is rounded in outline throughout nearly its whole antero-posterior diameter. The limit of the convexity on the vesical surface is visible, showing that more tissue has been destroyed in the middle of the lobe, and that the destruction has not quite extended to the peripheral edge of the lobe.

Bimanual examination with the cystoscope in the bladder and the finger in the rectum showed the tissue posterior to the urethra to remain about 1.5 cm. and the left lobe to remain about 2 cm., but the latter is more prominent than the right lobe, which is less than 2 cm. on its vesical surface. The elevation which was present on the right lobe at the previous examination is absent, the cystoscope not being drawn in during its rotation. The left lobe, by rectum, is larger than the right. The right lobe, however, still remains the harder. There is no induration and the surfaces are smooth. The median raphe is still slightly convex to the left.

After Discharge from the Hospital.—On September 1, 1903,

three months after the patient's discharge from the hospital, an examination of the bladder showed a residual urine of but 3 dr. The patient passed his urine but once during the night, and held it for from three to five hours during the daytime. There was no pain, and no difficulty in starting the urine, which came in a fair stream and which had more projection than at any time since he had been under observation. There was practically no

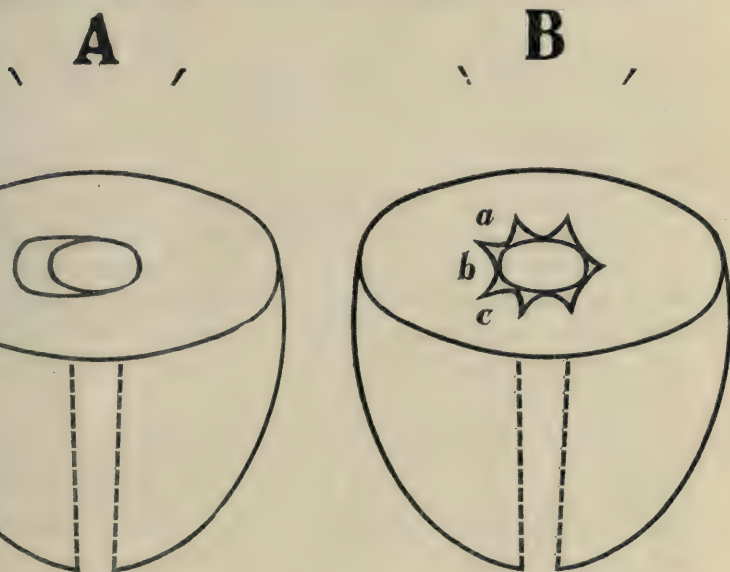


FIG. 2A.—Diagrammatic record of the cystoscopic fields at the vesical outlet, showing three deep convex fields, *a*, *b*, *c* in the right lobe.

B.—The actual shape of the vesical outlet determined by transposing the cystoscopic pictures recorded in A, showing the enlarged vesical outlet produced by sloughing away of the tissue about the incision. (Compare with photograph of the specimen.)

dribbling. The anæmia was much improved. The white cells were 6,500; red cells, 3,500,000; hæmoglobin, 45 per cent.

In November, 1903, the patient was readmitted to the Boston City Hospital on the service of Dr. John L. Ames, because of a return of the anæmia and its associated symptoms. I wish here to express my thanks to Dr. Ames for placing the record at my disposal.

Blood Examination.—Leukocytes, 8,000; red cells, 912,000; Hgb., 25 per cent.; achromia and poikilocytosis marked. Differential count: Neutrophils, 67.6; basophiles, small, 22.5;

basophiles, large 5.3; eosinophiles, 4.6; no normoblasts or megaloblasts.

The patient had been growing weak for about ten days, and during this time had noticed an increasing difficulty in performing the act of urination.

A large soft rubber catheter was passed into the bladder without difficulty, and 12 ounces of residual urine was withdrawn.

The ease with which the catheter was passed showed that the prostatic urethra was of fairly large calibre.

Urine Examination.—Pale; slightly acid; slight trace of albumin; sp. gr. 1.010; small amount of sediment consisting of a small amount normal blood; some pus; a few hyalin casts, with blood and renal cells adherent; occasional brown granular casts; much squamous and round cells epithelium.

The residual urine constantly increased in amount with the progression of the anæmia, and six weeks later the right kidney could be felt when the bladder was full but not so when empty. The residual urine had reached 36 ounces, and the twenty-four-hour amount ranged between 85 and 100 ounces. The anæmia at this time was most pronounced.

Blood Examination.—Leukocytes, 8,800; red cells, 656,000. Differential count: Polymorphonuclears, 73 per cent.; basophiles (small), 6 per cent.; basophiles (large), 18.5 per cent.; eosinophiles, .5 per cent.; transitional, .1 per cent.; two megaloblasts and one normoblast.

Urine Examination.—Pale; neutral; sp. gr., 1.008; slight trace of albumin. Considerable sediment, consisting of pus, normal blood, some small round cells and squamous epithelium; some neck of bladder cells; no casts.

As the anæmia began to improve the patient experienced less difficulty in the act of urination, and after a stay of three months in the hospital the anæmia had greatly improved and its symptoms were absent. The residual urine at this time had dropped to 10 ounces.

Blood Examination.—Leukocytes, 11,300; red cells, 2,928,000. Differential count: Polymorphonuclears, 71.2 per cent.; large mononuclears, 6.2 per cent.; small mononuclears, 17.3 per cent.; eosinophiles, 4.5 per cent. Eight mast cells and no blasts.

During the next month the anæmia continued to improve, and the residual urine dropped to five ounces.

There was again a remission of the anæmia and the residual urine gradually increased in amount as the general weakness progressed.

He was admitted to the Long Island Hospital April, 1904.

The general physical examination was as noted at the City Hospital. The blood examination at this time was: Leukocytes, 6,400; red cells, 472,000; Hgb., 10 per cent.; some poikilokyttosis and achromia. Differential count: Basophiles, 32 per cent.; neutrophiles, 68 per cent. No eosinophiles or blasts.

The bladder was overflowing constantly and an effort to urinate resulted in the passage of only a few drachms. There was no obstruction to the passage of a No. 18 Fr. soft rubber catheter.

Urine Analysis.—Pale; acid; sp. gr. 1014; slightest possible trace of albumin; no bile or sugar. Considerable sediment, consisting mostly of pus. Occasional calcium oxylate crystals and a few small and large epithelial cells.

This attack of anæmia was not so pronounced nor did it persist as long as his previous attacks, and six weeks after his admission to the Long Island Hospital the red cells had increased to 1,616,000, there was only slight achromia, one megaloblast and no normoblasts, and the Hgb. had risen to 30 per cent. At this time the bladder emptied itself except for two drachms. Micturation occurred every two hours during the day and but twice at night. The stream was a little slow in starting, came in fair volume with but little projection and there was slight dribbling after the act.

Urine Examination.—Normal color; normally acid; sp. gr. 1011; slightest possible trace of albumin. Small amount of sediment, chiefly pus, with occasional squamous epithelial cells.

The patient continued to gain in strength, and in July, 1904, he was out daily and able to do light work. The Hgb. at this time was 75 per cent. The bladder emptied itself except for three drachms. Urination occurred every four hours during the day and once or twice during the night. The stream started without difficulty, was of good volume, and had fair projection. A No. 20 Fr. soft rubber catheter could be passed into the bladder without difficulty. The urine was normal in color with but little sediment.

The patient's general condition remained good, and in Jan-

uary, 1905, bladder symptoms were absent and the residual urine was but three drachms. The blood examination at this time showed red cells, 2,960,000; Hgb. 45 per cent. Differential count: Neutrophiles, 81 per cent.; basophiles, 18 per cent.; eosinophiles, 1 per cent. One normoblast and three megaloblasts.

In May, 1905, bladder symptoms were absent and there was a residual urine of two drachms. The patient's general condition was good and he was discharged from the hospital.

The patient did light work and remained in fairly good general health for four months. He was readmitted to the Long Island Hospital in August, 1905, on account of a remission of the anæmia and its accompanying symptoms. The patient had lost much in general condition and had complete retention of urine.

This attack of anæmia was pronounced in severity and his general condition remained poor, and the bladder had to be emptied regularly by the catheter for nearly four months. The red corpuscles dropped as low as 1,408,000 and the Hgb. to 15 per cent. The urine became very turbid, the albumin increased, and there was much sediment, consisting of pus, squamous epithelium, casts and renal elements.

About four months after readmission to the hospital there was a gradual improvement in the patient's general condition and the red cells reached as high as 2,400,000 and the Hgb. 50 per cent. At this time the bladder emptied itself except for one ounce.

This improvement was of short duration, the anæmia returned and the patient became very weak. There was complete retention of urine.

Blood Examination.—Red cells, 1,004,000; Hgb., 20 per cent.; marked achromia and poikilocytosis. Differential count: Basophiles, 30 per cent.; neutrophiles, 67 per cent.; eosinophiles, 3 per cent.

The patient failed rapidly from this time on, became uræmic, and died one week later.

Following is the autopsy report of the urinary tract, made by Dr. S. B. Walbach, pathologist at the hospital, and also a photograph of the specimen (Fig. 3):

Kidneys.—Both kidneys tightly adherent to surrounding fat and muscle tissue. The left kidney is apparently one-third smaller than the other. Both are soft, lobulated, fluctuant. On section both are found



FIG. 3.—Note the crescentic area outlined by dots at the right of the apex of the trigonum, extending into the prostatic urethra to the right of the verum montanum, which is the area of incision of the Bottini operation. Note that the urethra on this side of the verum montanum is greater than on the left, and that the prostatic urethra is unobstructed throughout. Note the thickening of the bladder wall and pronounced surface markings. Note the dilatation of the ureters etc., hiding pelvices and calyces, and the small amount of renal parenchyma.

to consist of a series of peripherally arranged cavities 0.5 to 2 cm. in diameter, communicated with enormously dilated pelvis. The surrounding parenchyma is very thin, averaging 1 to 3 mm. thick. The pyramids are atrophied and not demonstrable except in the lower pole of the right kidney, where the cavities are smaller. The capsules are much thickened, dense, white, about 0.5 mm. thick, and cannot be separated from the kidney. Both kidneys contain thin greenish yellow puriform material. The lining of the pelvis in places is thick, and injected, giving a velvety appearance.

Ureters.—Both are greatly dilated with much thickened walls. Circumference ranged from 3 to 4 cm. Both show ballooning just before entrance into the bladder. The left ureter leaves the pelvis of the kidney by a tortuous, S-shaped route. Ten cm. above the bladder orifice there is an obliquely placed constricting ridge, projecting into the lumen, reducing the circumference at this point to 2 cm. The right ureter, 20 cm. above the bladder orifice, on posterior wall, has a diverticulum running upwards for 2 cm. This recess has about the same calibre as the main lumen of the ureter, which is constricted here to about 2 cm. The wall between the ureter and recess is thick and on section appears as if formed from the fusion of the walls of adjacent limbs of a loop.

Bladder.—Contracted. Contains about 60 cc. of greenish yellow puriform material with abundant coagula. Walls are thick, trabeculated. Mucous membrane is folded, injected, velvety. Some greenish discoloration. Orifices of ureters are prominent and allow easy passage of probes. To the right of the apex of the trigonum is a crescentic cicatrix extending into the urethra.

Prostate.—Not large, rather flabby, prostatic urethra is large, lined with scar tissue continuous with cicatrix and bladder. The verum montanum is pushed to the left, and there are two parallel folds of mucous membrane running from it to the apex of the trigonum. The channel to the right of the verum montanum, that which is lined with smooth dense white tissue, is 3 cm. long. Below this the urethra is normal.

REMARKS.

The feature of this case which it is desirable to emphasize is the five repeated attacks of intermittent urinary retention associated with the relapses of the anæmia. Concurrent with the changes in the blood and weakness of the general muscular system the bladder wall has lost its contractile power and retention of urine has resulted. As the anæmia has improved and the muscle system has regained its tone the bladder symptoms have diminished and have even been absent. The retention has gradually improved with the patient's general strength

and between the anæmic attacks the bladder has been able to empty itself, except for a drachm or two.

Of course the changes in the upper urinary tract—the hypertrophy of the bladder wall, the dilatation of the uterus, kidney pelvices and calices, and the infection and destruction of the kidney tissue dependent upon the prolonged intermittent intravesical pressure—have still remained.

The case also illustrates the value of the Bottini operation in affording relief to prostatic obstruction by incising the obstructing portion of the gland in a class of cases which will not stand general anæsthesia or the shock and convalescence attending prostatectomy.

That the Bottini operation was of benefit in overcoming the obstruction in the prostate and that these changes in the upper urinary tract were not due to an obstruction to the out-flow of the urine is evident from the fact that between the anæmic attacks the patient was able to start his urine easily, that it flowed freely in fair volume and that the bladder was emptied of its contents except for one or two drams.

The post-mortem specimen shows a patent prostatic urethra at the site of the operation, and demonstrates that the new channel made by the Bottini incision has not become, nor shows any tendency towards becoming obliterated during the three years time.

ARTHROPLASTY UPON THE ELBOW JOINT.

BY CHARLES L. SCUDDER, M.D.,

OF BOSTON, MASS.

Surgeon to the Massachusetts General Hospital.

THE following case illustrates the result of a plastic upon an ankylosed elbow joint one year and four months after the operation.

The patient was an adult man, 48 years old, a farmer and a carpenter by occupation.

The right olecranon was fractured by a fall from a wagon, April 21, 1905. There was at the time very great swelling about the elbow, and considerable displacement forward of the shaft of the ulna. The arm was extended, and covered with wet compresses for eight days. On April 29 the joint was opened through a posterior incision by the attending physician. Three fragments of bone were removed from the joint. An attempt was then made to wire the remaining fragment of the olecranon to the shaft of the ulna. Primary union followed in the superficial parts. The arm was immobilized for two weeks, and then gentle motion was begun. A few days later crepitus was noticed in the region of the fracture. A radiograph was taken, which disclosed a broken wire and the separation of the fragment of the olecranon from the ulnar shaft.

At this time the patient first came under my observation, July 6, 1905.

The elbow joint was almost completely ankylosed at an obtuse angle. There was a little movement possible, both actively and passively at the elbow joint, about 5 degrees.

In July, 1905, I did an arthroplasty upon the elbow joint by the following technique:

Steps in the operation of arthroplasty: Exposure of the joint by section of the olecranon; preparation of the joint and bony surfaces; making the fascial-fat flap; placing of the flap; suture of the olecranon fragment; closure of the joint; immobilization.

A long posterior incision was made, dividing all structures to the fascia, excepting that at that part of the incision over the back of the upper arm only the subcutaneous fat tissue was exposed. The olecranon was separated from the shaft of the ulna at the original point of fracture. Sharp flexion of the elbow exposed the joint surfaces, whereupon all adventitious bony and periosteal tissue was removed. The synovial membrane of the joint was thoroughly excised, a small bit of bone from the tip of the coronoid process was removed, and the ends of the bones were thoroughly freed.

The skin over the back of the upper arm was reflected laterally the whole length of the incision. A rectangular flap was then taken from the posterior surface of the upper arm, about three inches wide and five or six inches long, which included the fascia of the upper arm together with a small amount of subcutaneous fat tissue left when reflecting the skin flaps in the primary incision. When this flap was reflected the muscles of the back of the forearm were completely exposed. The pedicle of this flap was attached just above the posterior surface of the elbow joint.

The flap was rotated and swung into the joint, and placed between the ends of the exposed bones. The flap covered the lower end of the humerus, and the sigmoid cavity of the ulna and the upper end of the radius. The flap was held in position by a few interrupted sutures to the farther side of the joint.

The olecranon fracture was sutured by aluminum bronze wire. The fascia and ligaments about the joint were approximated so as to completely close the joint. The subcutaneous tissues were closed by interrupted sutures. The skin was sutured with silk worm gut. The wound was not drained. The arm was fixed at a right angle by an internal angular splint. Gentle passive motion was given at the end of about ten days.

At the present time, one year and four months following the operation, the man has a strong and useful arm, with which he is able to do all the work about a small farm.

The amount of movement at the elbow joint is seen in the accompanying photographs. Figs. 1 and 2 show the amount of motion three months following the operation. Figs. 3 and 4 show the amount of movement at the present time, one year and four months after the arthroplasty. In Figs. 3 and 4 is also illus-



FIG. 1.—Voluntary extension three months after operation.



FIG. 2.—Arthroplasty. Voluntary flexion three months after operation.



FIG. 3.—Arthroplasty. Voluntary flexion one year four months after operation. Note flexion of fingers.



FIG. 4.—Arthroplasty. Voluntary extension one year four months after operation. Note extension of fingers.



FIG. 5.—Arthroplasty. X-ray taken one year after operation. Note the line of section of olecranon to render easy access to joint. Note clear space corresponding to new elbow joint. Olecranon is solidly united to shaft of ulna.

trated the amount of flexion and extension of the fingers. Slight pronation and supination are possible.

The elbow does not trouble the man excepting for the small amount of limitation of motion. He has no pain and no discomfort with the joint locally that is of any importance. During wet weather there is a little feeling of discomfort about the joint, which he attributes to "rheumatism."

Fig. 5 shows the conditions as determined by the X-ray taken one year after operation. The olecranon process has united firmly to the shaft of the ulna by bony union; the wire is seen in place. It is broken at one point. The clear space of the joint is to be especially noted.

X-ray pictures taken previously to this one were not suitable for reproduction, but compared with this plate it is certain that there is no new formation of bone going on about the joint. The possible motion in the joint has not diminished since the first. Therefore it is reasonable to suppose that we have to-day in this case the final functional result of the operation.

There are certain facts of interest in connection with this operation of arthroplasty upon the elbow joint.

An ample incision greatly facilitates the operation. By section of the olecranon the exposure of the joint is easy, and the insertion of the triceps tendon is preserved intact. Consequently, after operation extension of the forearm is possible. The normal strength of extension is also maintained.

In the usual operation by a median posterior incision for complete excision of the elbow joint the power of extension is lost, or at most is very weak.

It is important, as Murphy of Chicago has pointed out, to clear the joint thoroughly of all adventitious tissue, as well as of any synovial membrane remaining. In a joint opened by the above method, in which the wound is closed by layer suture, there is no abnormal lateral mobility, no wobbling.

Murphy has found that the leaving of a thin layer of fat tissue attached to the fascia, to be used for the flap, is advantageous in the formation of a new joint.

The temporo-maxillary joint, the elbow joint, and the hip

joint are best suited to this form of plastic surgery. This procedure is best avoided in elderly individuals. It is adapted to the joints of children and young adults.

Persistence in passive and active movements after operation is essential to securing the greatest possible motion in a new joint formed by arthroplasty.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, November 28, 1906.

The President, DR. GEORGE WOOLSEY, in the Chair.

CONGENITAL LUMBAR HERNIA THROUGH THE TRIANGLE OF PETIT.

DR. CHARLES N. DOWD read a paper with the above title, for which see page 245.

DR. JOHN F. ERDMANN said that about four years ago he saw two cases of congenital lumbar hernia, both on the left side, and both quite typical. The first patient, a child of two years, was lost sight of. The second, a child of four years, was operated on by Dr. Erdmann. The hernial protrusion was through the triangle of Petit, and no difficulty was encountered in closing the defect by bringing together the latissimus dorsi and the external oblique muscles.

CYSTS OF THE SUPRARENAL BODIES.

DR. ANDREW J. MCCOSH read a paper with the above title.

DR. CHARLES H. PECK said the possible extension of these suprarenal cysts upwards, and their pressure against the wall of the diaphragm, to which Dr. McCosh had referred in his paper, recalled a case which came under his observation last summer. In that instance there was an extremely large cyst, filling the upper left quadrant of the abdomen. It was firmly adherent to the surrounding structures, and while the supposition at the time of operating was that it sprang from the pancreas, it might have had its origin in the left suprarenal, although its surface did not present the orange colored spots which Dr. McCosh men-

tioned as indicative of suprarenal cysts. An attempt to enucleate the cysts was abandoned when it was found that it had invaded the right thoracic cavity, passing beneath the ligamentum arcuatum internum. The entire hand, with the exception of the thumb, could be inserted into the opening beneath this ligament into the thoracic cavity, barely reaching the upper limit of the cyst, which compressed the lung and parietal pleura.

The cyst was emptied and drained, the patient made a good recovery from the operation and was well the last time Dr. Peck saw her.

ADVANTAGE OF THE LATERAL POSITION IN CERTAIN OPERATIVE PROCEDURES.

DR. F. TILDEN BROWN demonstrated a folding-board which he had found very useful for the purpose of obtaining a satisfactory exposure of the iliocostal space in operations on the kidney and prostate with the patient in the lateral position. He also emphasized the importance of relieving the patient's chest from the pressure of the overlying arm during narcosis, and showed an upright upon which the arm could be suspended.

DR. F. KAMMERER said he also had found the lateral position of great advantage in difficult nephrectomies. To prevent turning over on the abdomen or on the back the speaker usually had the pelvis of the patient firmly held by a nurse seated at the lower end of the operating table. Of course the sound side had to be supported by some firm pillows or some device similar to the one shown by Dr. Brown. Speaking of position Dr. Kammerer said that he had had a rather disagreeable experience last spring with a patient on her abdomen over the customary inflated rubber pillow, Dr. Thos. L. Bennett administering the anæsthetic. The operation of nephrectomy had been underway for about 10 minutes when the pulse rather suddenly became weak and rapid, going as high as 180 a minute. The condition of the patient became critical and, at Dr. Bennett's suggestion, the position was changed to the lateral and the pillow removed. The condition immediately improved and the pulse in several minutes dropped to 120.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held November 5, 1906.

The President, DR. JOHN B. ROBERTS, in the Chair.

LAMINECTOMY FOR TUBERCULOSIS OF THE SPINE.

DR. JAMES K. YOUNG presented a girl, 14 years of age, who, on February 7, 1902, fell on the ice, striking the dorsal region against a step. Two months later, she was sent by her attending physician to the Orthopædic Hospital and a brace was applied. In the spring of 1903 she was admitted to the University Hospital for beginning loss of power in the lower limbs. Subsequently she was admitted to St. Joseph's Hospital and to the Polyclinic Hospital. In January, 1906, she was admitted to St. Joseph's Hospital under his care, and he performed a laminectomy the day following her admission. Throughout all this time from the date of the accident to the time of operation her condition had progressed steadily worse, with slight intervals of improvement. The 8th, 9th, and 10th vertebræ were involved; there was a marked kyphosis, and paraplegia came on early and was intermittent, but steadily growing increasingly worse. Fourteen months before the operation her limbs became spastic and she had exaggerated knee jerks, marked ankleclonus, and Babinsky reflexes on both sides, with at times crossed reflexes. There was still some motor power. The following month, November, 1904, she could walk around the bed holding on for support, but rather awkwardly. One week later she could walk alone, and there was great improvement.

She again relapsed after this, and in April, 1905, upon her admission to the Polyclinic Hospital, she was completely paralyzed

and there was slight incontinence. In July, 1905, there was complete motor paralysis with slight incontinence which increased until at the time of the operation there was complete incontinence and complete motor and sensory paralysis.

On January 19, 1906, an incision five inches long was made from the third to the eleventh vertebra, the spinous processes of the ninth and tenth vertebræ were removed, and the lamina of the ninth vertebra was removed. An abscess was found beneath this on the right side which was opened and drained. A catgut drain was inserted and the wound closed, except for the drainage.

On February 26 the sensation in the lower extremities was slightly delayed but was present on both sides, and slightly hyperesthetic. The patellar reflexes were exaggerated, ankleclonus was present on both sides, the left more marked, and Babinsky reflexes were present on both sides and were marked. There was some contraction of the right knee at this time. Thermal sensation was diminished.

She was treated with electricity and massage and sent to the seashore. The motor power has gradually improved, the abscess has closed, and she is now able to walk a short distance unassisted, and has regained perfect control of the bladder and rectum.

Dr. Young said that two points were illustrated by this case, first, the diagnosis of abscess by the intermission of symptoms, improvement and relapses; second, the possibility of recovery by means of the operation of laminectomy after complete loss of motion and sensation.

He did not share the ultra-conservative opinion expressed by some surgeons in regard to laminectomy, but believed that under certain conditions this operation is a justifiable one. For abscess pressing upon the cord and for early spastic contractions of the extremities he believed the operation should be performed earlier than is customary.

DR. HENRY R. WHARTON said the case reported by Dr. Young was eminently one for laminectomy, the presence of an abscess in the spinal canal showing that the patient's condition was hopeless without operation. Simple rest in some cases of Pott's disease results in restoration of motion and practical recovery, but in others laminectomy is the only alternative. The diagnosis of abscess is difficult; as pointed out by Dr. Young, intermissions in improvement are a valuable sign in this respect.



FIG. 1.—Double lower lip.

DR. YOUNG, in closing, said the crossed Babinsky reflex was the unusual feature of the case. Usually this sign is present on one or both sides. Here it was present on both sides and irritation of one foot caused the reflex on the opposite side.

TRUE DOUBLE LOWER LIP.

DR. JOHN B. ROBERTS presented a patient upon whom he had operated for the removal of a true second lower lip. The photograph (Fig. 1), taken before operation, showed the double lip to consist of a thick outer lip and a thinner internal structure separated from the outer by a deep fossa lined with mucous membrane. In the median line of the mouth the two lips were fused together at the vermilion border and downward to the attachment of the structure to the alveolar portion of the mandible. The inner lip was dissected from the outer and encised. The raw surface was then covered by drawing flaps of mucous membrane over it. The patient's curious anomaly was corrected and his appearance much improved.

EXCISION OF HALF OF THE LOWER JAW AND HALF OF THE TONGUE FOR EPITHELIOMA.

DR. H. S. CARMANY exhibited, by invitation, a patient on whom he had operated one year previously for carcinoma of the tongue and jaw. The disease was of three months duration, and extended from the under surface of the tongue to the alveolar process of the inferior maxilla on the right side, and from a little beyond the median line to the last molar tooth. It was painful and growing rapidly, and the cervical glands were enlarging on the same side. Dr. Carmany excised the lower jaw on the right side from just below the sigmoid notch to a point a little beyond the median line, and with it the right half of the tongue, the submaxillary gland and a few small cervical lymph glands. The wound healed kindly, and the man has remained in good health. Dr. Carmany asked the opinion of the Fellows as to the advisability of applying a dental splint in these cases.

DR. CHARLES F. NASSAU said that one should never operate on carcinoma of the lower lip, tongue or jaw without taking out the glands of the neck. Twelve years ago Dr. Nassau operated in this manner upon two patients and five years afterward both were still free from recurrence. In any extensive growth of the

jaw there is almost surely infection of the neighboring glands before they are palpable. Their removal is just as necessary as in connection with carcinoma in other portions of the body where the lymph channels are followed in the dissection. In Dr. Carmany's case life has undoubtedly thus been prolonged.

DR. CHARLES H. FRAZIER said, in response to Dr. Carmany's inquiry regarding the use of dental splints in connection with partial resections of the lower jaw, that it had been his habit in his clinic at the University Hospital, always to consult a dentist prior to the operation. Dr. Cryer or one of his assistants had always been kind enough to examine the case before the operation and construct a temporary splint, which was applied at the completion of the operation. A permanent splint in the meantime may be made and adjusted after the wound is healed. By adopting this method the disfigurement accompanying the removal of the lower jaw may be largely, if not altogether avoided.

DR. JOHN B. ROBERTS said that he had seen a case of this kind in which Dr. McBurney had a dental appliance made before operation. It was held in place by a spring and fitted so well there was almost no deformity of the part.

RUPTURE OF THE KIDNEY.

DR. MORRIS BOOTH MILLER, by invitation, reported the history of a man of 31, a special officer of the B. & O. Railroad, who while chasing thieves fell, striking on his left side over the lower rib. He walked a distance of fifty feet before feeling faint. He then passed by urethra what appeared to be at least a quart of blood and twenty minutes later a second quantity containing many clots. While on his way to the Polyclinic Hospital on a street car he was obliged to leave the car and again pass blood and urine. He walked into the hospital where six ounces of blood were withdrawn by catheter. Dr. Miller saw the man one and one-half hours later. There was no shock but the side was rigid and tender and an indistinct dull mass could be felt in the loin. An oblique lumbar incision was made. A mass the size of two fists was revealed and opened, showing extensive hæmorrhage and rupture of the kidney. The two poles were separated and the finger could be passed between numerous small fragments into which the middle segment of the organ had been divided. This caused severe bleeding. Wicks of gauze

were placed against the kidney in front and behind, and by pressure the poles were brought approximately together. The patient did well, hæmorrhage practically ceasing in five days though at two later periods blood appeared in the urine. The amount of urine passed was at first 22 ounces but soon rose to 30 and then to 40 ounces. On the seventh day the wound dressings showed the presence of urine which then leaked through the back for a period of two weeks, the quantity being estimated at 20 ounces a day. On the twelfth day the packing was all removed and the opening finally healed. Suppuration was not present in the wound at any time. The temperature chart of the patient shows three rather sudden rises, probably due to cystitis as the bladder was frequently washed.

DR. HENRY R. WHARTON stated as his personal experience that conservative surgery of an injured kidney is good surgery. He knows of several cases in which there were symptoms of ruptured kidney, including hæmorrhage from the urethra and a mass in the side, and the majority recovered. Another class of cases is formed by those in which infection occurs and abscesses form in the loin or abdominal cavity. He has also seen several of this type in which urinary fistula followed opening of the abscesses, but these sinuses all closed spontaneously.

DR. CHARLES F. NASSAU agreed with Dr. Wharton that it is not always necessary to operate on a ruptured kidney; this accident is probably more frequent than generally alleged. One patient, a woman, undoubtedly had a severe kidney injury, as shown by a mass in the loin and bloody urine for several days. She recovered. A second case was seen in the absence of a hospital colleague and would have been subjected to operation had he not been going to return soon. The colleague waited and did not operate for ten days. By that time the patient had bled so much he died when under operation. Some days ago a man was kicked in the back by a horse, the injury being followed by hæmaturia with free blood in the abdominal cavity, as clearly shown by physical signs. The pulse increased rapidly and the abdomen was opened. A rent in the liver four inches long was found, but in addition there was blood behind the peritoneum and the kidney was found torn in half and absolutely loose from all surrounding structures. The kidney was removed and the man did well. He passed 35 ounces of urine on the third day.

He then developed pneumonia and died in two days. If in cases of kidney injury hæmorrhage continues and other conditions do not prevent it, an incision into the loin is indicated. This has not even the danger of an abdominal section and will at least get rid of a hæmatoma which might otherwise become infected.

DR. JOHN B. ROBERTS described the case of a boy of 10 or 12 who was run over by a wagon, the wheel passing over his abdomen. He was brought to the Polyclinic Hospital where nothing definite regarding his condition could be determined. There was pain in the abdomen as though due to local peritonitis but the abdomen was not opened. In two weeks all symptoms had disappeared and the boy was discharged. Two or three weeks afterward he came in with an enormous bulging mass in the right side which was dull and tender. An incision gave vent to limpid fluid and it was supposed that there had been rupture of a ureter or that a traumatic hydronephrosis had been tapped. Examination of the fluid led to the report by the pathologist that it was from a cyst of the pancreas. This appeared to the operator to be unlikely. Later the fluid that came from the drainage tube was examined and reported to be urine. Dr. Roberts does not know whether the fluid first obtained actually came from the pancreas and the later drainage from the urinary tract or not; but the boy recovered and is now perfectly well.

DR. FRANCIS T. STEWART regards the time before operation as the proper time for conservatism. If operation be necessary, radical procedure is then probably the best, as often the kidney will be found badly injured and had better be removed, although, of course, one must be guided by the conditions found. The dangers are hæmorrhage and sepsis. The two early indications for operation are a progressively increasing hæmatoma and constitutional symptoms of hæmorrhage. Usually these two go together. Sepsis is at times a later indication. Hæmaturia is not necessarily an indication for operation. His chief difficulty has been to make a correct diagnosis. In one case, that of a man injured by a crush, a large amount of blood was passed by the urethra, the abdomen was rigid and there was marked shock. Rupture of the bladder was suspected by Dr. Gibbon who also saw the case and Dr. Stewart believed the condition to be a rupture of the kidney. Incision revealed intact kidneys and bladder and a ruptured liver. In this case, although the man

died of hæmorrhage from the liver, the pulse never rose above 100, though it was very weak. In another case, secondary hæmorrhage after an abdominal operation, a large quantity of blood was passed by the urethra though there had been no injury of the bladder, ureter, or kidney. A third case was that of a boy who had been kicked in the abdomen. The symptoms were those of an intraperitoneal lesion and no blood was found in the urine. Operation revealed no injury to the abdominal viscera but a ruptured kidney. The kidney was removed and the case terminated satisfactorily. In several cases of moderate bleeding he has operated and afterward been sorry that he had interfered.

DR. JOHN H. GIBBON said he saw the man referred to by Dr. Stewart and because of blood passed by the urethra regarded the case as one of probable rupture of the bladder. He agrees with Dr. Stewart as to conservatism in cases of injury of the kidney when hæmorrhage is not sufficiently severe to cause death. He does not agree with the statement that hæmorrhage severe enough to demand operation usually means an injury sufficiently extensive to require nephrectomy. The question of nephrectomy must be decided when the kidney is exposed. If the rupture extends into the pelvis of the organ and implicates large vessels the kidney should be removed. He has seen cases in which one-third of the kidney was separated from the remainder of the organ by blood clot terminate in good recovery after removal of the clot and insertion of packing. If suppuration does not occur in such cases one has a right to believe that function of the kidney has been restored. Removal of a kidney is so easily done that some are removed when nephrectomy is not demanded; this is also true of the spleen. Dr. Gibbon believes that a kidney which shows numerous lacerations, as did the one in Dr. Miller's case, is easier to save than is one containing a single large rent. A good working rule in rupture of the kidney is that if the bleeding can be controlled the kidney should not be removed.

DR. MILLER, in closing, said the justification for immediate operation in the case reported was the hemorrhage. Often in these cases if the surgeon waits he loses the favorable moment for operation. Dr. Miller agrees with Dr. Gibbon that only when the kidney is exposed can the surgeon determine what is the wisest procedure. In his case he decided that barring anuria or later suppuration the man might get well with a functioning

kidney. It is to be remembered in deciding these cases that the patient has only two kidneys and if one be removed, loss of the other means death. So far as nephrectomy is concerned, the ruptured kidney in his case could have been removed with probably only slightly increased risk to the patient.

SARCOMA ORIGINATING IN THE ISCHIO-RECTAL FOSSA.

DR. GEO. ERETY SHOEMAKER said that sarcomatous growths may be found at widely distributed points in the body, as they may occur wherever there is a connective tissue. It is, however, unusual to find them situated in the ischio-rectal fossa. Sarcomata are from time to time reported in the pelvis, behind the peritoneum, involving uterus or ovary, intestine, sacrum or one of the iliac bones in the pelvic basin, but such cursory search of indices and such inquiry among surgeons as he had been able to make would indicate that the perineal or ischio-rectal region is a most unusual location for this form of tumor.

In a series of 54 cases of osteosarcoma of bones of the pelvis, collected by Havage*, there were none springing from the ischium or pubis and none in the ischio-rectal region. He now reported a case in which its early stage the differential diagnosis was difficult in comparison with a low grade of connective tissue inflammation. Careful observation, however, showed a continuous growth, a complete absence of tenderness, a discreet form, no tendency to involve the rectal wall and no tendency to point externally. On extirpation of the mass it proved to be a mixed type of sarcoma, with a small central area breaking down. The case was as follows:

A well developed, strong and vigorous girl of 21, a student in typical health, resident of Kansas. Family history negative, weight 118; tuberculosis in a maternal uncle and in a grandmother. Menstruation regular and normal, no history of injury of the part. One month before being referred by her physician a lump about the size of a walnut was noticed deep in the left perineum; aching, but with neither pain, tenderness nor throbbing. No history of discharge and none of constipation. Had been unusually well for a year. Examination showed superficially to the left of the rectum and vagina and behind a line drawn

*Tumors of the Pelvis. 1882.



FIG. 2.—Sarcoma of ischio-rectal fossa. Two-thirds normal size. Age 21.

from the posterior vaginal commissure to the tuberosity of the ischium, extending from the rectal wall out nearly to the ramus of the pubis and nearly to the tuber ischii, a mass three inches from front to back, two inches from right to left, against the rectal wall but not infiltrating it, firm, somewhat movable. No softening, no redness. The condition resembled a low grade of inflammation in the pararectal tissues but was too firm. As a definite increase in size occurred with a tendency to greater fixation, the diagnosis of tumor was made (Fig. 2).

An antero-posterior incision over the prominence was made $1\frac{1}{4}$ inches to the left of the median line, immediately opposite the center of the perineum. There was no true capsule and no sharply defined line between normal and new tissue. Small areas of hardening projected from the growth anteriorly toward the vulva. At no point was the skin or mucous membrane involved. One or two small tortuous subcutaneous veins were visible. The growth invaded all tissue up to the rectal and vaginal walls and between them and the tuber ischii including muscle and fat. Half an inch behind the edge of the ischium it appeared to be firmly attached. The fingers were used to enucleate the mass and by blunt dissection it was separated from the pubis and ischium. It did not appear to infiltrate or expose bone. A superficial portion of the sphincter ani was preserved and only the superficial portions of the left labium majus. The constrictor vagina on the left side was sacrificed and the erector clitoridis cut in two. Hæmorrhage was not severe. The trunk of the internal pubic was caught behind the tuber ischii, giving a comparatively dry field. The tumor removed was three inches in antero-posterior diameter, $2\frac{1}{2}$ inches in lateral diameter and 2 inches from without inward. The deeper parts of the wound were partly drawn together with catgut and the skin united except at the center, where gauze drainage was applied. There was no secondary hæmorrhage. Marked œdema of the anterior portion of the genitalia developed, making catheterization very difficult. Union appeared at the end of the first week, except at the point of drainage. There was no lack of control of the sphincter ani, but complete anæsthesia of the rectum and vagina on one side from division of nerves. The rectum did not slough.

Microscopical examination of the growth in the Laboratory of the Presbyterian Hospital showed sarcoma of mixed type.

Although every vestige of visible or tangible disease was removed at the operation, recurrence was rapid locally and generally. The vulva and perineum of the left side were first invaded, the inguinal glands later. At the end of six months a mediastinal pressure is interfering with respiration and death is reported as imminent. Trypsin treatment has been used by her Kansas physician without benefit.

DR. CHARLES F. NASSAU cited a case seen three years ago which was similar to that of Dr. Shoemaker's, even to rapid recurrence and death. The patient was a young man sent to the hospital with the diagnosis of ischiorectal abscess. Suspecting malignancy, Dr. Nassau cut very wide of the lesion, taking everything to the tuberosity of the ischium. The tumor recurred in three months.

EXTREMELY VICIOUS UNION OF A FEMORAL FRACTURE SUCCESSFULLY TREATED BY OSTEOTOMY, NAIL- ING AND VERTICAL TRACTION.

DR. JOHN B. ROBERTS showed skiagraphs of this case to illustrate, (1) an unusual displacement as the result of a fracture; (2) the result gained by the use of nails and traction, and (3) the unreliability of the X-rays. The patient was a child of three years who was thrown down in a field by a calf winding him in the coils of a rope. He was seen by Dr. Roberts at the end of eleven weeks, when the leg showed five inches shortening. Operation by Dr. Roberts showed that the femur had been fractured, the fragments crossing and also being twisted. There was solid union and great force was required to chisel apart the fragments. Contraction of the muscles could not be entirely overcome by pulling. The fragments were adjusted, but still overlapped; to prevent twisting again taking place, two fracture nails were driven into them; and horizontal traction applied by the ordinary method. At the end of a week the nails were withdrawn, the leg put in the vertical position and a weight applied to stretch the muscles. The leg is now straight, there is solid union and careful measurement shows a shortening of about one and one-half inches. The skiagraph taken shows what appears to be an overlapping of three inches. The Crookes tube was probably not carefully placed over the fracture when the exposure was made. The medical profession should now deprecate too great reliance on the

X-rays. Skiagraphs, taken as they usually are by a man who is not a surgeon and who does not know the case, are apt to lead to erroneous deductions. They may lead us into errors and should not be relied upon as much as people usually think.

DR. GEORGE G. ROSS agreed with Dr. Roberts as to the danger of the X-rays in fracture work; the picture is correct, but the interpretation is wrong. As corroboration of clinical diagnoses he has used many skiagraphs. He advises against having skiagraphs of results taken, as there may clinically and functionally be a satisfactory termination and yet the X-rays shows an amazing condition.

DR. ROBERTS replying to a question as to how much was gained by traction upon the leg after removal of the nails, said that the nails were put in to prevent twisting, not overlapping, as he was afraid the original twist would recur. The nails were a temporary expedient to maintain apposition of the raw bone surfaces. As he thought that five days were sufficient to prevent twisting, the leg was then placed in the vertical position and traction with a weight and pulley applied. He does not know exactly how much was gained by this expedient but he felt that the operation had reduced the shortening from five to three inches. As the leg now is only one and one-half inches shorter than its fellow, he believes that he gained about three and one-half inches by the operation. There is, of course, the possibility that the legs were of unequal length before the fracture occurred.

BULLET WOUND PIERCING LUNG, DIAPHRAGM, AND THE SPLEEN.

DR. R. P. McREYNOLDS said gunshot wounds which penetrate the lungs, the diaphragm and some one or more of the abdominal viscera are not unusual but they are perhaps rare enough to justify the report of the following case which was seen in a private house in consultation with the attending physician, Dr. M. Graham Tull. A sixteen-year old boy attempted to shoot himself through the heart; but his knowledge of anatomy was not accurate and he missed his aim. The bullet entered the seventh interspace, mid-nipple line, ranged downward, passed through the diaphragm and came out posterior between the eleventh and twelfth ribs mid-scapular line.

DR. McREYNOLDS saw him within an hour of the accident;

he had some dyspnœa, and some pain, but on the whole his general condition was good; he was but little shocked and the external hæmorrhage had been insignificant. But from the range of the bullet, the rigidity of the abdominal muscles and a marked increase in the leukocytes an immediate operation was advised. He was hurried to the Presbyterian Hospital and under general anæsthesia the abdomen was opened high up through the left rectus muscle. The spleen was found to have been almost bisected by the bullet and was bleeding freely; none of the other abdominal organs were injured. An attempt to suture the wound in the spleen was made but failed and resort was had to tamponnage—the gauze being placed so as to approximate the edges of the wound and to stop the hæmorrhage. The usual after-treatment for such cases was instituted and wound healed by granulation.

From the thoracic wound a septic pneumonia developed from which a long and severe illness followed. However, he finally made a good recovery and now, two years after the injury, is strong and healthy.

Remarking upon this case Dr. McReynolds said that there are no early physical pathognomonic signs of internal hæmorrhage; prompt surgical action will however establish the diagnosis, and in the majority of cases give the patient the best chance for his life. In abdominal injuries requiring laparotomy, the rule “when in doubt operate at once” seems to be a good one. Penetrating wounds of the lung give a high mortality and the treatment of such cases is not altogether satisfactory. Dr. Rodman, in an excellent monograph on this subject, has very aptly summed it up in two words—“masterly inactivity.” This is certainly the accepted treatment of all simple penetrating wounds of the thorax, such as usually occurs when the wound of entrance is above the sixth interspace. But if the wound is below this point and there is reason to believe the diaphragm has been punctured and the abdominal viscera injured, the modern tendency is towards masterly activity. Dr. Daniel H. Williams in an article published in the *ANNALS OF SURGERY*, November, 1904, advocates resection of a rib, suturing the rent in the diaphragm and following the wound to the end. The success in a number of cases so treated would seem to justify this procedure, especially in cases where there is no wound of exit and therefore an uncertainty about the injury to the abdominal viscera.

Statistics show that gunshot wounds of the spleen have been most always fatal, the majority of the cases dying from hæmorrhage and generally within twenty-four hours. In dealing with a splenic wound there may be a choice of several procedures, *i.e.*, Suturing with catgut and reenforcing by sewing the omentum over it. Tamponnage with strips of gauze. Splenectomy. Cauterization. The first two are the methods of election. It would seem that the ideal procedure would be to close the wound with catgut sutures and then reinforce by sewing the omentum over it.

The spleen was first sutured by Lamarchia in 1896; his patient promptly died from hæmorrhage (he did not sew the omentum over the wound). However, others have been more successful—there are in this country two and probably more cases reported of successful splenorrhaphy. Treatment by tamponnage has given very good results. Berger in exhaustive statistics covering one hundred and twenty-seven cases of splenic wounds from various causes treated by laparotomy records ten cases treated by tamponnage with only one death. Successful cases of ruptured spleen treated by this method have been reported by Gibbon, Brewster and others. Senn from extensive experiments upon dogs concludes that marginal compression of the wound by hæmostatic forceps should precede the introduction of the catgut sutures, claiming that the compression diminishes the hæmorrhage and permits of the more easy and successful introduction of the sutures.

If the spleen has been so extensively injured that it cannot be sutured and tamponnage will not control the hæmorrhage a splenectomy is indicated; but this materially adds to the danger. The kind of the operation performed is not of so much importance as the time when it is performed. He had seen two cases of rupture of the spleen and both lost their lives, he thought because they were not operated on early enough.

PHANTOM URETERAL CALCULI.

DR. FRANCIS T. STEWART exhibited X-ray plates which were made from a patient in whom Dr. Dwyer suspected ureteral calculus because of pain radiating from the iliac regions to the loins, and the passing of large numbers of uric acid crystals. No blood was found in the urine. The plate, taken by Dr.

Manges, shows shadows which at first were thought to be those of ureteral calculi. There were five on the left and two on the right side, one being large as a pea. More careful examination of the plate raised the suspicion that the shadows were not those of ureteral calculi, as the five on one side were not in perfect alignment and were outside the course of the ureter. Further investigation was decided upon and the bladder was inspected and both ureters catheterized, the latter appearing free. Both vaginal and rectal palpation, however, showed between the vagina and rectum extremely hard, apparently calcareous masses, five on one side, and two on the other. They were not excised, hence their nature is unknown, but they were thought to be phleboliths. Cystoscopy showed that the orifice of the right ureter was in the middle line and that of the left further to the side than normal, so the situation of shadows out of the usual line might in some cases be regarded as due to calculi in the ureter.

The diagnosis of ureteral calculi by the X-rays is not absolutely positive, whether shadows are or are not shown. In one case ureteral colic was felt on one side, but two X-ray plates proved negative. As there was a little blood in the urine and colic persisted it was concluded that the X-rays were wrong. Catheterization of the ureter showed no obstruction, but as no urine came through the catheter for ten hours salt solution was injected. Aspiration then brought away many uric acid crystals which may have caused the obstruction. Dr. DaCosta has reported a case of calcareous lymphatic gland supposed to be a ureteral calculus. He operated in this case upon a perforated gastric ulcer which was followed by a long-persisting sinus. Incision finally showed at the bottom of the sinus a fecal and calcareous concretion. It is not known if this mass came from the stomach. Foreign bodies in the intestine may deceive the skiagrapher, though careful operators see that the bowels are well opened before taking the picture.

DR. JOHN B. ROBERTS said the possibility of erroneous showing of the X-rays is an interesting topic. In one instance under his observation they did reveal that a resident physician was not giving his patient proper attention and reporting all that he should. The patient had diarrhoea and had been given bismuth by the resident without reporting the matter to the surgeon. A skiagraph, taken for a lesion of the hip, incidentally showed by

reason of the bismuth an impacted rectum, to which the diarrhoea was due.

DR. WILLIS T. MANGES, who had taken the skiagraphs exhibited by Dr. Stewart, said the X-ray makes no mistake but man makes the mistakes. Its character is shown by the fact that by it a foreign body in the eye or other part of the body can be localized and its position determined with absolute accuracy. The average hospital skiagrapher has too many cases to examine to do careful work. Dr. Manges has noticed in other cases shadows similar to those in Dr. Stewart's plates. In one case with symptoms referable to the genito-urinary tract, the kidney region showed no evidence of stone, but on skiagraphing the pelvis there was shown two or three small, perfectly round bodies on either side, apparently calcareous or other hard masses. These bodies in the pelvis have been noticed only in cases examined for calculi. At times it is difficult to distinguish them from calculi, but ureteral calculi are rarely found. Among the skiagraphs exhibited by Dr. Manges was one of a patient who had ureteral or renal colic. There was no tenderness of the ureters and catheterization showed no obstruction; there was no blood in the urine. Dr. Manges made the diagnosis of ureteral calculus. The patient refused operation and improved. He is undetermined as to the exact condition present. The shadows are in the position of ureteral calculi, but they are perfectly round. Now in such a case, instead of insisting on operation he would say that calculi were not present. In another case of renal colic, blood in the urine, tenderness, but no obstruction to the catheter, the skiagraph showed small shadows which were not round. Two weeks later the patient had another attack of colic and a skiagraph then showed no bodies. In still another case of Dr. Stewart's the skiagraph agreed with the clinical diagnosis, but the patient refused operation. One year later a skiagraph showed a ureteral calculus still present. There was no obstruction to a catheter though the calculus was large as the end of a finger. The question is what are the small perfectly round bodies in the pelvis at times in the position of calculi or at other times near the brim of the pelvis where they clearly are not calculi? Dr. Manges intends to experiment upon cadavers for the purpose of determining what these bodies are.

DR. JOHN H. GIBBON, referring to the case mentioned by

Dr. Manges in which skiagraphs were taken one year apart, said he examined three plates, each showing the presence of a body. Clinically there were attacks of renal colic. A catheter was passed, but that does not rule out the diagnosis of ureteral calculus, as he believes it possible to pass a catheter when a calculus is present. He believes the man has a calculus. Dr. Gibbon showed two plates, one of a case of ureteral calculus and one in which none was present. The one proved to be no calculus though there was blood in the urine and tenderness over the ureter. The skiagraph shows what appears to be a large stone. The case was very deceptive, but after going over it several times the diagnosis of stone was made. When the abdomen was opened there was found a large hard body, but it was situated in the broad ligament instead of in the ureter. When removing it the mass ruptured, allowing the escape of material resembling white lead. The capsule was tense and it was finally decided the mass was tuberculous. The pathologist has not yet given an opinion as to its nature. This body had cast a shadow in the position of the ureter. The plate that does show a calculus was made from the patient from whom Dr. Gibbon removed the large cystic kidney shown at the previous meeting of the Academy. The calculus was removed by the extraperitoneal method. The patient is making a good recovery.

DR. GEORGE ERETY SHOEMAKER said he frequently turns phleboliths out of the pelvic veins during operations upon women. He has seen a loose calcareous body the size of a pigeon egg free in the peritoneum. Very small dense masses of dermoid material must also be reckoned with forming either the whole or part of dermoid tumors. He has seen one entire dermoid the size of a bantam's egg and one smaller. In one girl a calcareous mass was found against the bladder on the peritoneal side. Cheesy bodies in the pelvis are common. That day he had with difficulty turned out back of the broad ligament a sac with thick organized wall and cheesy contents resembling an ovary. This mass was the result of inflammatory and retrograde changes and would have given an X-ray picture in the line of the ureter.

DR. KELLY, who examined the bodies removed from the frimbria by Dr. Stewart, said there were five bodies about twice the size of the head of a pin and were round and smooth. They were composed of fibrin with calcareous material in the center.

DR. STEWART, in closing, said that in addition to phleboliths, foreign bodies in the intestine, calcareous glands, defective X-ray plates and dermoids, two other conditions are to be remembered in this connection. First, atheromatous plates in a blood vessel. Second, small, hard, calcareous masses in the end of the Fallopian tubes. The latter seem to be composed of fibrin and calcareous matter. During the past week he found several calcareous masses of this character apparently spring from the fimbriæ of the tubes. These were in the line of the ureter and would have suggested ureteral calculi had an X-ray plate been made.

CORRESPONDENCE.

BONE METASTASES OF HYPERNEPHROMA.

EDITOR ANNALS OF SURGERY:

I wish to add to the paper upon the "Bone Metastases of Hypernephroma," which appeared in the December, 1906, ANNALS OF SURGERY, the following two cases of bone metastases, which were accidentally omitted from the cases then reported.

CASE I.—"Report of a Case of Malignant Hypernephroma, with Metastatic Growths in the Bones and Two Spontaneous Fractures of the Femur." E. R. LeCount. Trans. of the Pathological Society (Chicago), 1902, V, p. 82.

CASE II.—"Hypernephroma of the Kidney with a Metastatic Growth in the Superior Maxilla." E. R. LeCount. Trans. of the Pathological Society (Chicago), 1905, VI, p. 373.

CHARLES L. SCUDDER.

BOSTON, MASS.

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ORIGINAL MEMOIRS.

SARCOMA OF THE LONG BONES.*

THE DIAGNOSIS, TREATMENT AND PROGNOSIS, WITH A REPORT OF
SIXTY-NINE CASES.

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OF NEW YORK.

Attending Surgeon to the General Memorial Hospital; Associate Surgeon to the
Hospital for Ruptured and Crippled.

THE subject of sarcoma of the long bones has for many years been a topic of great interest to the surgeon and the pathologist. The classic paper of Gross¹ published in 1879, based upon a study of 165 cases of sarcoma of the long bones, collected from American and foreign reports, was the first comprehensive work upon this subject. Gross's paper was so exhaustive and covered the ground so thoroughly that it was long before any other writer presumed to enter this field. There were, however, certain inherent defects, or rather deficiencies in Gross's paper: first, his cases were all treated before the days of antiseptic surgery and, hence, the mortality from operation was exceedingly high; second, comparatively few cases were traced to final results, thus rendering impossible any accurate idea of the true prognosis of the disease; third, his cases were collected from scattered reports, mostly individual. Inasmuch as successful or particularly interesting cases

* Read before the Chicago Medical Society, December 5, 1906.

are much more likely to be reported than failures, such a series of cases as Gross's, would be less apt to conform to the actual clinical picture of the disease, especially regarding results, than a total series of cases observed by a single surgeon or treated at a single clinic.

To fill this gap in our knowledge of sarcoma of the long bones, it follows that we must have a series of cases treated since the advent of antiseptic or aseptic surgery, comprising all the cases observed by a single surgeon or at a single clinic during a given period.

Three papers on sarcoma of the long bones published since Gross's, have, in a measure, fulfilled these conditions. The first, that of Nasse,² based upon a study of 46 cases observed at von Bergmann's clinic during a period of fifteen years, from 1874 to 1889. The second, that of Reinhardt,³ who reports 54 cases observed at the Göttingen clinic (König) from 1880 to 1895. The third and most recent paper is that of O. Kocher⁴ reporting upon a series of 65 cases observed at the Tübingen clinic (Professor v. Bruns) from 1860 to 1903.

It is true that many of the cases observed at v. Bruns' clinic and some of those reported by Nasse date back to a period prior to antiseptic wound treatment; but Reinhardt's series were all treated since 1880.

Mayer²⁰ has taken up the statistics of v. Bergmann's clinic in 1889, or the end of the period covered by Nasse, and has endeavored to complete the statistics up to the year 1904. He has tabulated 91 cases, but, unfortunately, he has not separated the sarcomas of the bones from those of the soft parts, and has also included all sarcomas of the extremities, taking in sarcoma of the fingers, the carpus and tarsus. Hence, it is impossible to compare these cases with Nasse's, or indeed with any series of cases of sarcoma of the long bones proper. No less than 51 of the 91 cases collected by Mayer must be excluded as it is not certain that they originated in the long bones.

Nasse states that while Gross's statistics are of interest in some respects, *e.g.*, his figures regarding the relative fre-

quency of periosteal and myelogenous sarcoma, the proportion in which the various bones are affected, the significance of trauma in the etiology of sarcoma, and the many symptoms that are observed in the course of the disease, his material is by no means sufficient to determine the different degrees of malignancy, *i.e.*, to express in figures the differences in final results according to the histological character of the disease or the method of operation employed. Such conclusions are particularly worthless when it comes to the different subdivisions of the rarer types of sarcoma. Besides, his methods of drawing conclusions are so evidently defective in many ways, that it is impossible to obtain from the same any kind of a reliable picture of the results of operation or the malignity of the sarcomas.

With these important and recent contributions to our knowledge of sarcoma of the long bones, it might well seem difficult to find an excuse for another paper upon the same subject.

The two reasons which I offer for the present paper are: *First*, the minor one, that my series of cases of sarcoma of the long bones is the largest yet reported by a single observer; *second*, one of much more importance, I believe, that the results in this series of sixty-nine cases warrant a very radical departure from the present recognized methods of treatment.

In proof of the fact that new methods of treatment of sarcoma of the long bones are urgently to be desired, we need but take a brief survey of the results of present methods.

As I have already stated, too few of Gross's cases were traced to final results to enable us to estimate at all accurately the prognosis of the disease. Passing on to the results at v. Bergmann's clinic (Nasse) we find only 4 of the 46 cases well beyond three years. Of these 2 were myeloid sarcoma of the femur; 1 a periosteal sarcoma of the humerus, and 1 a myeloid sarcoma of the tibia.

The results at König's clinic (Reinhardt), all observed during the antiseptic period, show 7 cases well beyond three

years. Of these 3 were sarcoma of the tibia, 1 of the femur, 2 of the humerus, 1 of the radius.

Of the 65 cases observed at the Tübingen clinic, 9 remained well beyond three years. Of these 3 were sarcoma of the femur, 3 of the tibia, 1 of the radius, 1 of the ulna.

O. Kocher was the first writer after Gross to attempt a compilation from the literature of all cases of cures of sarcoma of the long bones. He collected 48 cases which, with the 9 cures observed at Bruns' clinic, make a total of 57. Of these cases 4 were sarcoma of the radius, 1 of the ulna, 10 of the humerus, 23 of the femur, 12 of the tibia and none of the fibula. In the remaining seven the bone is not indicated.

All statistics show that the prognosis is decidedly worse in periosteal growths than it is in those of central origin.

Of the 57 cases of cures of sarcoma of the long bones, 30 were of the myelogenous type, 15 periosteal; in the remaining 12 the exact character of the growth was undetermined.

The nature of the operation performed in these cases of cure is of great interest: 21 were treated by amputation, 10 by ex-articulation, 17 by resection, 5 by curetting. In 4 cases the nature of the operation is not stated.

No one can help being struck by the large number of cases cured by resection; 17, or nearly one-third of the entire number, were thus cured.

The gloomy prognosis of sarcoma of the long bones, even in face of such radical operations as amputation or ex-articulation at the proximal joint, is still further emphasized by Butlin⁵ who, in a series of 68 cases of sub-periosteal sarcoma of the femur collected mostly from English and German clinics, reports only 1 case that remained well beyond three years, and in this case there was some reason to believe that the disease was of central rather than periosteal origin. Of 46 cases of sarcoma of the femur, of the myeloid type, collected by Butlin, 5 remained well beyond 3 years. In the cases of sarcoma of the tibia and fibula, the results were little better. Of 35 cases of the sub-periosteal type, only 1 remained well beyond two years, while of 52 cases of the myeloid type, 9 were well be-

yond three years. Butlin was able to collect only 18 cases of sarcoma of the humerus of the periosteal type, that had recovered from operation. Of these only 1 was known to have been well beyond three years; of 10 of the myelogenous type, 2 were well beyond three years.

Butlin concludes: "We cannot but form the opinion that the disease (periosteal sarcoma of the humerus) is horribly and rapidly fatal and that the prospect of complete cure, or even long immunity from recurrence, is singularly small." Of the sub-periosteal sarcomas of the femur, he states: "The cases which were followed up by Mr. Colby and myself were almost invariably fatal, and in the large majority of them death occurred within a few months of the amputation. In many of the cases amputation was performed within three months of the first observation of the disease; in some of them within a few weeks. From every point of view, I cannot but regard sub-periosteal sarcoma of the femur as a remarkably deadly disease, and I am not yet clear that surgery can do more than palliate the distress occasioned by it, and that only in a comparatively few cases. The only hope of the future is in very early diagnosis and in very high amputation."

Sufficient evidence has been cited to prove that the results of operative treatment of whatever kind, of sarcoma of the long bones in general, are extremely discouraging, while those of the sub-periosteal type, especially of the femur and humerus, are almost hopeless.

My own results of operation for sarcoma of the long bones have been quite as discouraging as those above mentioned. The great majority of my cases were treated by the routine methods now in vogue, namely, high amputation or ex-articulation at the proximal joint; in fact, I have resected in no case. While I have performed amputation at the hip joint eight times without mortality, 4 of the 6 patients in whom it was performed for sarcoma of the femur, died within the year; the fifth in one and one-half years and the sixth was not traced. In 2 in which the amputation was done for sarcoma of the soft parts, 1 died a year later and the other,

who had received several months' treatment with the mixed toxins prior to amputation, now remains well after a period of six years.

While sarcoma of the long bones may occur at almost any age, it is most frequently observed between the ages of twenty and forty. Gross, in 165 cases, found no case under ten years; 45 were between ten and twenty; 55 from twenty to thirty; 26 from thirty to forty; and only 21 between forty and 70.

Reinhardt, in 54 cases observed at the Göttingen clinic, also found no case under the age of ten years. In 35 of the 54 the disease occurred in patients between ten and thirty years; 23 were under the age of twenty.

In 35 cases the tumor had existed less than one year.

The youngest patient of the 65 cases observed at Bruns' clinic was ten years of age; the oldest seventy years; 18 were between ten and twenty; 21 were between twenty and thirty; 7 were between thirty and forty; 15 were between forty and fifty; only 4 were beyond fifty years of age.

My own, as far as I know, is the only series which shows any cases of sarcoma of the long bones under the age of ten years. I have observed 6 such cases, 1 a sarcoma of the humerus in an infant twenty months old, and 4 of the femur in patients aged seventeen months, six, seven and nine years, respectively.

With regard to the relative frequency of the disease in the sexes, statistics vary considerably. Gross's collection shows 149 cases in which the sex was known, 87 were men and 62 women. Of the 65 cases observed at Bruns' clinic 42, 64.6 per cent., were men; 23, 35.4 per cent., were women. Reinhardt's collection of 54 cases observed at the Göttingen clinic gives 40 occurring in men and 14 in women.

My own series shows a much more equal distribution between the sexes: 35 cases in the female, and 34 cases in the male. My oldest patient was aged fifty-six, and youngest twenty months. Six patients were under the age of ten years; 20 from ten to twenty years; 19 from twenty to thirty

years; 11 from thirty to forty years; 5 from forty to fifty years; 7 from fifty to sixty years.

Distribution of Sarcomas Over the Various Long Bones (author's series): Femur, 36; humerus, 13; tibia, 13; fibula, 2; radius, 3; ulna, 2; metatarsal bone, 1; metacarpal bone, 1. Total, 71. 34 periosteal. 22 central. 15 type not stated.

Method of Treatment: Amputation, 20; disarticulation, 16; conservative methods (resection), 6; no operation, 29.

A brief reference to the various methods that have been employed in the treatment of sarcoma of the long bones by the different operators may be of interest:

At Bruns' clinic (65 cases), of 57 cases treated by operative methods, amputation was done in 21, exarticulation in 10, resection in 17, curetting in 5; in 4 cases the method is not stated.

Resection was confined chiefly to the myelogenous type and was performed in only 3 out of the 17 cases of periosteal origin.

Thirty of the 45 cured cases of sarcoma of the long bones collected by O. Kocher were of the myelogenous type, 15 of periosteal origin. It is interesting to note that the method of resection was employed in 16 of these cases.

As to the relative frequency of involvement of the various long bones, Gross's statistics show the femur the seat of the disease in 67 cases: Tibia, 46; humerus, 25; fibula, 13; ulna, 7; radius, 6; ulna and radius together, 1.

Bruns' cases show the femur involved in 23 cases: Tibia in 12; humerus in 10; radius in 4; ulna in 1.

Nasse reports 15 cases of the femur; tibia, 10; humerus, 9; radius, 3; ulna, 1.

McCosh, in his paper ⁶ reporting the results of 125 cases of sarcoma of all regions, personally observed at the Presbyterian Hospital during the last fifteen years, states that "the majority of surgeons recommend amputation in all cases," and adds that he has never yet seen a case in which he felt that the interest of the patient would have been better served by resection than amputation. McCosh's personal results are, I

believe, the best that have been reported. Five out of 11 patients upon whom he performed amputation for sarcoma of the femur or tibia were well over four years. But, in spite of McCosh's opinion, and the fact that up to comparatively recently my own views and practice have been in accord with his, I am now inclined to believe that resection should be employed in a much larger number of cases of sarcoma of the long bones, particularly of the myeloid type in the radius and tibia, and the results obtained by v. Mikulicz⁷ and others, principally German surgeons, seem to justify such a change of attitude. I believe also that the use of the mixed toxins of erysipelas and bacillus prodigiosis after operation will greatly widen the limits within which the operation of resection may be safely employed.

The following cases will, I think, justify this conclusion:

CASE I.—Sarcoma of the Radius Treated by Resection. Patient Well Six Years Later.—Mrs. C. H., 26 years of age, first noticed a tumor in the lower end of the right radius in January, 1900. F. H. negative. No history of trauma. The tumor slightly increased in size, and on September 18, 1900, she was operated upon by Dr. R. A. Hibbs of New York. In a letter received from Dr. Hibbs, he states that 2 inches of the radius were removed. Microscopical examination showed the growth to be a giant-celled sarcoma. The space left from the operation gradually filled with granulations and remained open, requiring frequent packing, for nearly two years. In January, 1902, she consulted me for an opinion. At that time the granulation tissue so closely resembled a new growth, that I believed a recurrence had taken place, and advised amputation of the arm. She thereupon consulted Dr. Wm. T. Bull and Dr. Farquhar Curtis, both of whom advised amputation of the arm.

No further treatment of any kind was given except the continued packing of the wound until it finally healed.

I made a careful examination of this patient on November 28, 1906, six years after the operation, and nearly five years after I had previously seen her. There was not the slightest trace of a local or general return. The outer portion of the lower end of the radius has been replaced by new bone. She has perfect

control of the wrist movements and her arm is apparently as strong as before.

This case is certainly a very striking proof of the superiority of resection to amputation in certain myeloid growths of the radius.

The following case shows that with the aid of the toxins resection may be successfully applied even to the more malignant sarcomas of the humerus:

CASE II.—*Giant Round-Celled Osteosarcoma of Humerus.*—A. C., female, 31 years, patient of Dr. John Babst Blake of Boston. In December, 1896, the patient fell, striking the right side; three days later she noticed pain in the left shoulder, especially on motion. This slowly increased and in November, 1897, motion was limited and she was unable to use the arm. At this time the patient noticed a painful lump below the left clavicle. She entered the hospital on the twenty-second day of December, 1897. Physical examination by Dr. Blake at that time showed on the left side, just over the coracoid process, a small, oval, slightly tender and rather elastic swelling; skin movable and normal over it. Movements of shoulder limited, especially in exterior rotation, abduction and extension; limitation apparently due to pain.

December 24, 1897, operation by Dr. Blake: The coracobrachialis and pectoralis minor seemed directly continuous with it. On separating pectoralis major and deltoid, a bluish mass appeared. Dissection being stopped by hæmorrhage, mass was scooped out with the hand. The tumor apparently originated in the coracoid process and had destroyed the end of the humerus, both tuberosities and the entire glenoid cavity. The wound was irrigated with corrosive and four wicks were inserted,—one toward neck of humerus, one to coracoid, one to glenoid cavity and one behind greater tuberosity. Wound healed remarkably well. On January 18, 1898, a course of toxin treatment was begun and continued until July 28, 1898, the patient receiving in all from 20 to 25 injections. Pathological diagnosis proved the growth giant-celled sarcoma. November 27, 1906, or nearly nine years since the operation, Dr. Blake writes that the patient is well and strong, doing all the housework for a family of six; she has extraordinary motion, lacking only a certain amount

in direct extension upward of the hand and arm overhead. She has gained nearly 20 pounds. Dr. Blake showed her before the meeting of the American Medical Association in June, 1906.

Etiology.—It would be neither proper nor profitable to take up the question of etiology in a paper of this kind, but I may be pardoned for briefly stating that I believe sarcoma as well as carcinoma to be of microparasitic or infectious origin. The recent experiments of Drs. Beebe and Ewing with sarcoma in dogs have proved that these tumors can be easily transplanted from one dog to another; that such transplanted sarcomata are true new growths, and not infective granulation tissue, and while as yet there is no positive proof of their parasitic origin, to my own mind this explanation is most in accord with the known clinical facts. Whatever theory we adopt as to the origin of this disease, such theory must take into account the intimate relationship between sarcoma and antecedent injury or trauma.

In a series of 615 cases of sarcoma personally observed, there has been a history of injury in upwards of one-third of the cases. This fact is of too frequent occurrence and has been established by too unimpeachable evidence to be any longer thrust aside as an unimportant coincidence, without etiological significance. In a large number of the cases the tumor developed immediately after and at the exact point of injury in persons hitherto in a state of perfect health. If for the moment we assume sarcoma to be of micro-parasitic origin, it is most easy to explain the part that trauma plays as a causative factor: We know that tuberculosis is not infrequently localized in a given part of the body, a joint or a bone, by reason of a local trauma. Uhlmann (Warren's Surg. Path., p. 195, Osteomyelitis) states that, as a result of a large number of carefully conducted experiments, he was unable to produce the disease (osteomyelitis) by injection of the virus, until some kind of injury had previously been inflicted upon the bone. Therefore, we have reason to believe that the infectious cause of sarcoma, whatever it be, may remain for a long time,



FIG. 2.—Acute traumatic sarcoma of the femur (periosteal).
(Sagittal section.)



FIG. 1.—Acute traumatic sarcoma of the femur, following fracture (periosteal).

or perhaps indefinitely, in the system without harm, until the injury produces such a lowering in the vitality of the parts and their resisting power that the slumbering process becomes active and the neoplasm begins to develop.

In sarcoma of the long bones a history of trauma is even more frequent than in sarcoma of the soft parts. Gross found it in 70 cases in a total of 144 cases; Mayer found it in 31 per cent. of cases; Reinhardt in 16 per cent. of cases; Nasse in 15 per cent. of cases; Kocher in 20 out of 65; Ziegler in 67 out of 171. My own cases show accidental injury in 31 cases out of 66 in which the presence or absence of trauma was noted, or 47 per cent. In 3 cases the sarcoma developed at site of a fracture.

Diagnosis of Sarcoma of the Long Bones.—Given a tumor of the long bones, the most important step towards making a correct diagnosis is to get a careful clinical history of the case. Points of special importance:

- (1) The age of the patient.
- (2) Presence or absence of a history of local injury.
- (3) Hereditary influence, remembering that sarcoma not infrequently occurs in persons whose ancestors died of carcinoma.
- (4) General health of the patient may aid in differentiating sarcoma from tubercular disease, patients suffering from sarcoma, especially in the early stages, being usually persons in the most robust health.
- (5) Location of the swelling as regards proximity to a joint.
- (6) Presence or absence of pain.
- (7) Duration of the growth.
- (8) Periosteal or central origin of the tumor.
- (8a) Consistence of the tumors (presence or absence of fluctuation).
- (9) X-ray examination.
- (10) Examination of the blood.
- (11) Microscopical examination of a section removed either with a tumor punch, or by exploratory operation,

The condition that most closely resembles sarcoma of the bone is tuberculosis of the bone; its similarity is often so great that the most expert diagnosticians have failed to differentiate the two conditions. In some cases it may be quite impossible to make a diagnosis without the aid of a microscopical examination of a specimen removed, but inasmuch as there are certain risks connected with these exploratory incisions, it is most important to be able to make a diagnosis, if possible, without such aid. In the great majority of cases of sarcoma of the long bones, the following clinical picture will be found to be sufficiently accurate to enable one to render a correct diagnosis: The patient will almost always be between 10 and 50 years of age, the majority between 20 and 40; general health will be perfect; there will be no family history of tuberculosis and no evidence of previous tubercular lesions. There will be a history of local injury of some sort in one-third to one-half of the cases—a blow, a fall, fracture, a severe sprain—at some longer or shorter interval, usually less than six months, prior to the first appearance of the tumor. The first symptom the patient will have noticed will be local pain or local swelling, in about equal proportion of the cases. Gross states that pain occurs as first symptom in 62 per cent. of the cases, a tumor in 33 per cent. In many of my own cases pain has been absent as an early sign, and not of great severity until the later stages of the disease. The cases in which pain has been an early symptom have usually been treated for rheumatism for a longer or shorter time. In upwards of two-thirds of the cases of sarcoma of the long bones the tumor will be found located in one end of the bone, the lower end in the femur, the upper in the tibia and humerus, probably starting in the epiphysis, but very rarely invading the joint except in the later stages of the disease. In a few cases, especially those of the femur and tibia, it begins in the middle of the bone, and here it is nearly always the periosteal type, forming a fusiform enlargement of the shaft in the early stages when the diagnosis is important and treatment of value. The duration of the tumor or rapidity of its growth is also an important diagnostic sign.



FIG. 2a.—Sarcoma of the femur. Acute traumatic malignancy.
Photograph taken three weeks after a kick.

In nearly all cases the rate of growth is much more rapid than in either tuberculous or syphilitic swellings. In tuberculosis the joint is early invaded; there is more limitation of motion in the joint and more atrophy of the muscles of the limb above. Seen in the later stages when the whole joint is affected by the disease and the patient has become emaciated and exhausted, the similarity of sarcoma to tuberculosis is very great.

The consistence of the tumor in sarcoma varies greatly with the type of tumor. In growths of periosteal origin, in the early stages, the consistence may be very firm; later on, when the tumor has reached considerable size, especially in the round-celled variety, the consistence may be very soft and semi-fluctuating, the tumor itself being soft and mush-like in appearance. In other cases of periosteal sarcoma, while the consistence of the tumor in general may be quite firm, there may be areas of marked softening and, in some instances, fluctuation due to the liquefaction of bone or cartilage. The introduction of a sterile needle with the withdrawal of clear serum will enable us to differentiate the condition from tuberculous abscess. In still other cases, particularly the myelogenous sarcomas of the upper end of the tibia, the tumor may show areas of softening similar to those described and other areas which, on palpation, give the egg-shell crackling sensation which is fairly characteristic of the disease.

The temperature may offer some slight help in the diagnosis. A regular evening rise of temperature of 1 to 2° would be slightly in favor of tuberculosis, although it is not at all infrequent to find slight, irregular temperatures in sarcoma of the femur even in the early stages.

I have on several occasions observed a temperature of 99½° to 100° or 101° in sarcoma of the femur, and in some cases of sarcoma of bony origin I have seen a temperature of 103°.

In the very rapidly growing sarcomas of the bone, the tendency to rise of temperature is more marked. Involvement or non-involvement of the joint is of the utmost importance in

differentiating the two conditions. As stated before, in sarcoma the joint is very rarely involved, never in the early stages except in the exceedingly rare cases where the sarcoma begins in the synovial membrane (Rydygier).

v. Ruediger Rydygier, Jr., in his recent "Contributions to the Diagnosis and Therapy of Primary Sarcoma of the Knee-Joint Capsule," states that while sarcoma of the region of the knee joint is by no means rare, he has been able to find only 9 cases of primary sarcoma of the synovial membrane, to which he adds one case observed at Rydygier's (his father's) clinic. He has found all authors to lay special stress upon the great diagnostic difficulties of this trouble, and claims that the case observed at Rydygier's clinic is the first one in which the diagnosis of sarcoma was made before operation. The disease in this case had existed for two years prior to operation, showing the unusually slow course of sarcoma in this locality. Resection was done and the patient remained free from any signs of recurrence when last seen, a year after operation.

Rydygier points out the following characteristic symptoms of sarcoma of the synovial membrane:

In spite of the considerable swelling of the knee-joint region, motion is usually very little impaired, which he thinks is due to the fact that the periosteal covering of the joint surfaces and bone in most cases remain intact, the disease having no tendency to invade the neighboring parts. For this reason, too, there is absence of crackling or crepitus on motion, a sign generally seen in advanced stages of tuberculosis. There is little or no interference with walking, so that atrophy of the muscles is rarely pronounced. Pain, as a rule, is absent or insignificant. Puncture invariably showed sero-sanguinolent fluid or blood, but never pus. The inguinal glands were not involved in any of the cases observed, and with exception of one case, there was no rise of temperature in any of the reported cases.

Examination of the blood shows nothing at all characteristic. There is apt to be a slight leukocytosis, which may reach from 15,000 to 20,000, and occasionally there is an increase in lymphocytes, also an increase in the eosinophiles.

The contour of the tumor is of considerable importance. In tuberculosis starting in the epiphysis and soon involving the joint, the clinical picture is very different. There is swelling of the whole joint, more or less symmetrical, while in sarcoma, especially of the femur, the swelling is apt to be unilateral or more or less irregular, and does not extend into the joint, but

further up the shaft of the femur than is seen in tuberculosis. Not infrequently there are areas of softening or fluctuation in sarcoma, which can be made out on deep palpation and are due to the formation of a cyst by liquefaction of bone or cartilage, but this fluctuation never communicates with the joint, a fact which enables us to differentiate the trouble from tuberculosis. The color of the skin may be of significance; it is less pale than found in tuberculosis, and at times distended veins give it a bluish color.

While it is always wise, if possible, to have an X-ray photograph made of the tumor, in the great majority of the cases nothing characteristic will be found, except perhaps in the later stages when the diagnosis is easy without the X-ray. In the early stages—I agree with Butlin—that it is not only of little help, but in certain cases entirely misleading. The X-ray may be important in showing periosteal or central origin of the tumor, but I do not agree with Kramer¹² in regarding it as a valuable aid to diagnosis in the early stages.

The differential diagnosis between sarcoma and syphilitic lesions is not nearly so difficult. There will usually be found evidence of syphilitic trouble elsewhere in the body, even if no history of primary disease can be elicited. In addition to this, the fact of the much slower growth, the location of the tumor in the shaft of the bone rather than the extremity, will be sufficient to establish the diagnosis. There is one other condition, to which I have not seen attention previously called, but which in a case personally observed was mistaken for sarcoma by surgeons of great experience, and that is osteo-arthritis. In this case the X-ray was of decided help, as it showed a much larger amount of new bone formation and this formation much more irregular in character than is often seen in sarcoma. In addition the marked, almost complete ankylosis of the joint was most significant. Finally, further examination showing typical osteo-arthritic enlargement of every joint in both hands, made the diagnosis of osteo-arthritis of the knee certain.

In some cases, and perhaps in a considerable number, it

may be important to establish the diagnosis before the clinical signs are sufficiently marked to render this possible with any degree of certainty. In these cases we may remove a portion of the tumor either by means of a tumor punch, or, better, a simple exploratory incision. I believe that certain risks are attached to these preliminary explorations, due to the possibility of infected cells getting into the circulation, thus setting up metastases in other portions of the body. The advantages, however, to be gained by such positive knowledge of the nature of the growth, enabling the surgeon to apply immediate treatment, whether it be amputation or injections with the mixed toxins, far outweigh the dangers from exploratory incision. If the patient is put upon the toxins within a few days thereafter, I believe that whatever cells may have been carried through the circulation will by that time still be in a state of such unstable equilibrium, that they will probably be destroyed by the toxins. As a matter of fact, the early appearance of metastases after amputation in cases in which no preliminary exploration was made, has proved that the infected cells enter the circulation early in the disease.

I do believe it is impossible, in many cases, to make a differential diagnosis between sarcoma and cyst of the long bones, without a careful microscopical examination. In a few cases one may be able to differentiate the two conditions from the following points:

(1) Cyst of the long bones is very rare, D'Arcis, in 1906, having been able to collect from the literature but 31 cases.

(2) Nearly one-half of the total number of cases have been found in the upper end of the femur, a relatively infrequent seat for sarcoma. Six occurred in the upper end of the tibia, six in the upper end of the humerus.

(3) Another important point is that cysts of the long bones are, as a rule, of much longer duration than sarcoma. A history of trauma and spontaneous fracture are found with almost equal frequency in sarcoma and cyst. To show the difficulty in making the diagnosis, I would cite the following case:

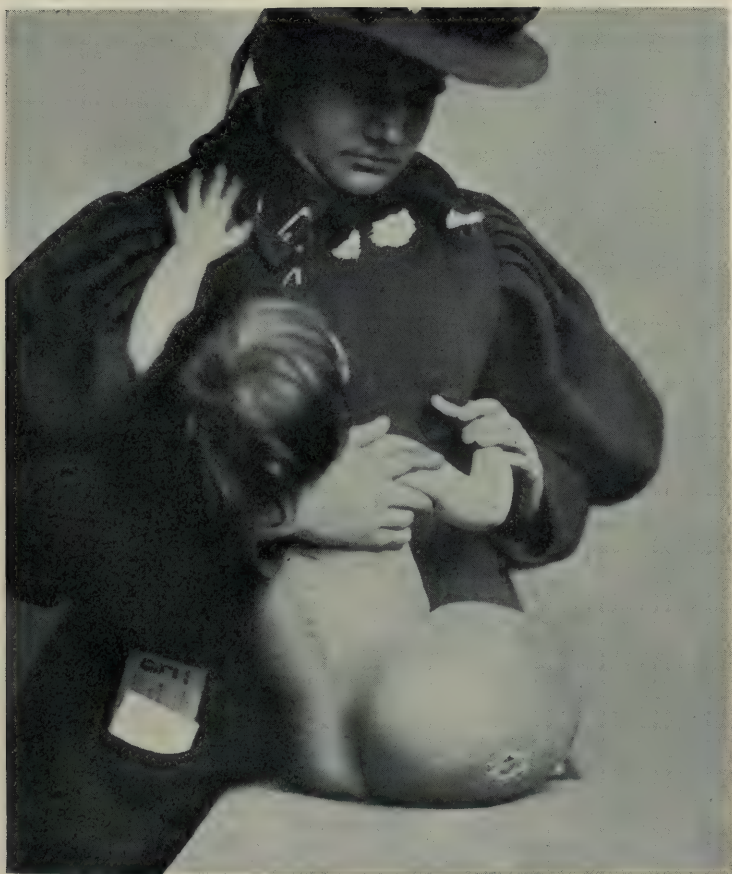


FIG. 3.—Sarcoma of the femur and ilium (Coley). Two months' duration, in infant aged one year and nine months.



FIG. 4.—Sarcoma of the femur (myeloid).



FIG. 5.—Periosteal sarcoma of the femur. Hip joint amputated.



FIG. 6.--Periosteal sarcoma of the femur. Specimen removed from patient shown in Fig 5.

CASE III.—J. S., aged twenty years, F. H. negative. The patient was referred to me by Dr. Townsend of the Hospital for Ruptured and Crippled, and admitted to the General Memorial Hospital March 7, 1906, with a history of having sprained his right ankle four years ago. A slight swelling appeared which never entirely disappeared. In July, 1905, he began to have pain on standing on the right leg. This pain and disability gradually increased up to the present time, and he has been unable to work since December, 1905. An exploratory incision was made by my associate, Dr. Downes, and on cutting through a very thin layer of bone just above the malleolus on the inner side, a large cavity was opened, extending 4 to 5 inches upwards. The same was filled with clear serum and of the lower end of the tibia there remained only a thin shell. Macroscopically, there was nothing that resembled tumor tissue; the case seemed to be one of those rare cases of cyst of the long bone. A piece of the bone removed with a chisel, however, was decalcified and microscopical examination proved it to be a round-celled sarcoma.

The toxins were given four to five times a week in large doses from March 7 to July 6, 1906. The patient was able to get about more easily. The leg decreased 1 inch in size. His later history I have not been able to trace.

I feel sure that had not great care been taken in removing a piece of the bony shell and having it thoroughly decalcified, the case would have been reported as a cyst of the long bone.

This case helps to confirm the opinion of certain authorities who believe that practically all cysts in the long bones are really sarcomas.

For further aids in diagnosis the reader is referred to the recent papers of Kummer,²⁴ Lexer,²² and Bokenheimer.²³

Reinhardt states that in spite of most careful consideration of all diagnostic points it is impossible in a certain proportion of cases to render a positive diagnosis without puncture or exploratory incision. In all cases of sarcoma of the bone observed at the Göttingen Clinic between 1880 and 1895, in which there was the slightest doubt as to the diagnosis, the tumor was incised or, if necessary, a piece of bone removed. In 54 cases exploratory incision was considered necessary in 34. Two of these were punctured; 29 incised. In one instance enlarged inguinal

glands were removed prior to the main operation, and the diagnosis rendered on basis of examination of these. In two cases the diagnosis of tuberculosis disease of the joint had been definitely made and resection was begun, when it was seen that the trouble was sarcoma. According to Reinhardt the most frequent difficulty has been to render the differential diagnosis between tuberculosis of the joint or joint-end and sarcoma in the region of the epiphyses. In many cases effusion into the joint adds to the difficulty. He cites a case showing that even after exploratory incision doubt may exist as to whether the disease is sarcoma or tuberculosis.

Sarcoma of the Femur.—More than half of my entire series of sarcomas of the long bones occurred in the femur, namely 36 out of 69.

The ages of the patients range between one and a half and fifty-eight years.

As regards the sexes, 17 patients were females and 19 males.

Amputation at the hip joint was performed in 13 cases; high amputation in 10 cases. In 13 cases no operation was performed, the patients being either too far gone for any operation, or refusing operation, as was the case in two or three instances.

In 4 cases the mixed toxins were used after operation as a prophylactic against further recurrence. Twice they were used in cases of sarcoma of the upper end of the femur, too extensive even for hip-joint amputation. One of these cases was treated at the Montefiore Home for Incurables. The tumor had been pronounced inoperable by Dr. Gerster, of Mt. Sinai Hospital. A specimen removed was pronounced round giant-celled sarcoma both by Dr. Mandlebaum, pathologist to the Mt. Sinai Hospital, and Dr. T. M. Prudden, Professor of Pathology to the College of Physicians and Surgeons, Columbia University. The disease was advanced so far as to produce spontaneous fracture. The patient finally recovered under the mixed toxins and has remained well since more than four years.

In a second case, personally treated by me, the result was even more remarkable, since here we had to deal with a subperiosteal sarcoma of the small round-celled type, involving



FIG. 7.—Round-celled sarcoma of the femur (periosteal). (Bull.)

the lower two-thirds of the femur. In addition there were extensive metastases in the pectoral region and the iliolumbar region. The patient had absolutely refused amputation. Metastases had occurred while he was taking the X-ray treatment in 1902. Finally, under the mixed toxins, he recovered fully. I presented him before the New York Surgical Society in November, 1906, four years later.

In two other cases the toxins were used before resorting to amputation. One, a case of myeloid sarcoma of the lower end of the femur, in a girl of 16 years, on whom the treatment was begun in April, 1906. The first two to three weeks there was marked improvement; later the tumor again began to increase in size, and at the end of five weeks amputation was done below the trochanter. After the patient recovered from the operation, she was put upon the mixed toxins again and the treatment was kept up for five months at the Hospital for Ruptured and Crippled. She has gained 38 pounds and is in perfect health at the present time, eight months later.

A second case, in which I have used the toxins before amputation in sarcoma of the femur, is that of a boy of ten, with a fusiform round-celled sarcoma starting in the middle of the left femur and involving six inches of the shaft. The toxins were begun on the last of November and have been continued up to the present time, February 16, 1907. The tumor at once showed a decrease in size. The pain, which was severe, disappeared after the first two injections. At the end of two weeks there was a decrease in size of one inch. December 25, the doses were reduced from 11 minims to 2 to 3, and an increase was again noted. The patient is still under treatment and the doses have again been increased with the hope of avoiding amputation. January 4, 1907, the tumor is smaller than at any time since treatment was begun, the circumference of the thigh having decreased from $11\frac{3}{4}$ to 9 $\frac{1}{2}$ -16. February 16, 1907, the patient is steadily gaining weight and there is a reasonable hope of saving the limb.

In five cases the toxins were used after amputation in sarcoma of the femur, without waiting for a recurrence. In

one of these cases, a periosteal sarcoma of the middle of the femur, the patient lived two years, dying of local and general recurrence. The other four patients are still alive, but too short a time has elapsed to warrant their being called cures. One is well eight months, 1 seven months, 1 six months, and 1 five months.

The results in the 12 cases treated by hip-joint amputation were as follows:

Of the 6 cases operated on by myself, all recovered from the operation, but the 5 that were traced all had local or general recurrence within a few months, and 4 died within eight months and the fifth within a year and a half. One patient was lost sight of after three months. Of the remaining 5 in which the operation was done by other surgeons, but which came under my care before or after operation, the results were as follows:

One, a girl aged thirteen years, operated upon by Dr. Rushmore, remained well when last seen, five years after operation. Of the other 4, 3 died within a year, and the fourth was not traced.

In short, of the 13 cases treated by hip-joint amputation, only 1 was cured, and, without exception, the deaths all occurred within a year after amputation. There seemed to be little difference in the malignancy, whether the tumor was periosteal or myeloid.

Of the cases treated by high amputation below the trochanter, 10 in number, 1 died two years later. (He received toxin treatment for several months after amputation.) One died four months later of metastases in the lungs; a third died seven months after operation of metastases; a fourth died six months after operation. The other cases were treated with the mixed toxins immediately after amputation below the trochanter, and remain well at the present time, five, six, seven and eight months after operation. Two patients have gained between 26 and 38 pounds each and none shows any signs of recurrence. The toxins were given for five months in 2 cases and 2 others are still under treatment.

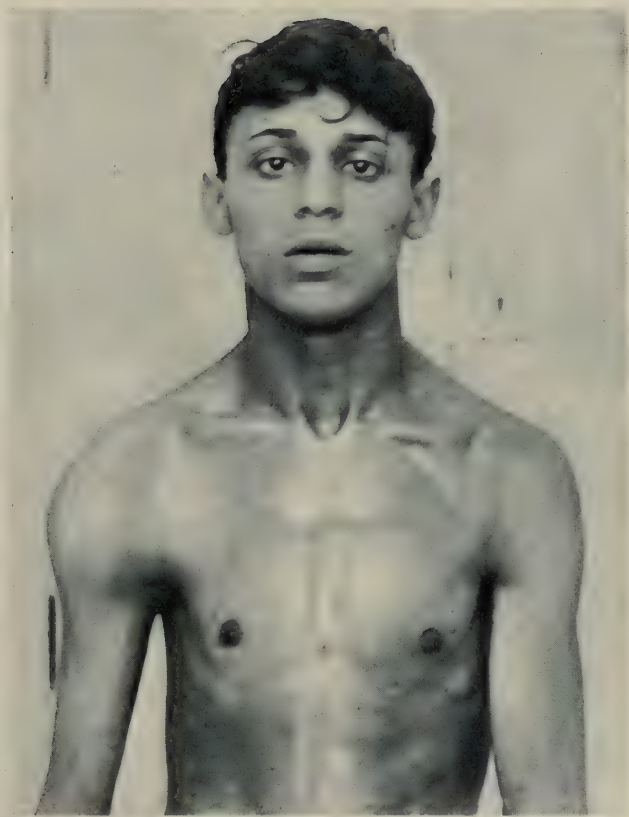


FIG. 8.—Sarcoma of the humerus (Coley). Two month's duration. Case IV.

Sarcoma of the Humerus.—Sarcoma of the humerus is very rare and exceedingly malignant. The upper end of the bone is most frequently involved, but the whole shaft is quickly invaded; the surrounding tissues are infiltrated. In a case which was personally observed and in which I performed amputation at the shoulder joint, half the clavicle was involved and most of the scapula. The disease quickly recurred in the portion of the clavicle remaining, with metastases in the spine. In sarcoma of the humerus, there seems to be a special proneness to recur in the opposite humerus; this has been noted in 2 cases personally observed.

While diagnosis ought to be possible in the early stages, a study of the reported cases will show that early diagnosis is seldom made. In 2 cases the patients were treated for rheumatism until the tumors were about the size of a cocoanut. The rapidity of the growth was undoubtedly enhanced in the one case by the electric vibrator treatment and, in the other, by vigorous application of osteopathy. In neither case had there been any history of previous rheumatism.

The sudden discovery of a hard, painless swelling in the humerus, especially in its upper portion, with or without previous injury, in an apparently perfectly healthy individual, should arouse strong suspicion of the presence of sarcoma. Almost the only condition likely to be mistaken for it would be a chondroma, which is much rarer and of very much slower growth.

The following case shows well the extremely rapid course of this disease:

CASE IV.—*Sarcoma of the Humerus.*—I. S., 19 years, born in Germany, admitted to the General Memorial Hospital May 21, 1906; died July 5, 1906; no treatment employed. F. H. negative. On admission the patient gave the following history: No trauma. Pain in the right shoulder for three months; swelling was noticed at about the same time, in January, 1906. The swelling increased very rapidly. The patient first entered Mt. Sinai Hospital on April 10 and amputation at the shoulder joint was advised by Dr. Gerster. The patient left the hospital, and

when re-admitted a month later, the tumor had increased so markedly, that operation was entirely out of question, and the man was referred to me by Dr. Gerster. Examination at this time shows the right humerus the size of an adult head, measuring $10\frac{7}{8}$ inches at the elbow, just below the tumor; the tumor itself showed a circumference of 25 inches. The patient's general condition was extremely bad, he was greatly emaciated; weight $95\frac{1}{2}$ pounds. The tumor had grown to such dimensions that the arm, in a recumbent position, instead of lying against the side, was pushed 4 inches outward. Shortly after his admission to the hospital, spontaneous fracture occurred. Sharp spicules of bone punctured the skin at the lower extremity of the humerus; 12 pounds of bloody serum exuded during the next 24 hours; several quarts continued to exude daily until the time of death, July 6. His condition on entrance was such that no toxin treatment was deemed advisable.

This is one of the most rapidly progressing cases that I have ever seen, the total duration of life being about 5 months from the time of the first appearance of pain to death.

The growth in sarcoma of the humerus is so rapid that one can see its increase in size from day to day. In the cases that I have observed, 13 in number, pain has been a fairly early sign, but has not been severe until the tumor has reached considerable size. The tumor originated in the upper end of the bone in all cases except 1, in which it started in the middle. The pain was never marked except in the later stages of the disease. Sarcoma of the humerus shows a greater tendency to infiltrate the neighboring tissues, both bone and soft parts, than sarcoma in any other locality. The axillary glands are not infrequently involved, and the scapula and clavicle are early invaded by the disease. The almost hopeless prognosis in these cases is shown by the collections of Barling¹⁰ and Dent.¹¹

Of the 13 patients in my series, 5 were females, 8 males, and their ages ranged between twenty months and fifty-eight years; 5 were under twenty years of age and only 3 over thirty years. Antecedent injury was noted in 4 of the 13 cases.



FIG. 9.—Case IV. Sarcoma of the humerus, four months' duration (Coley).

In 10 of the cases the tumor had been observed less than six months; in 3 cases from one to three months.

Methods of Treatment.—In 4 cases amputation was refused, though strongly urged. Amputation at the shoulder joint was performed in 6 cases, with 1 death from shock. (In this case the tumor was very large. I saw the patient in consultation and advised operation, but it was performed by another surgeon.) Resection was performed in 3 cases.

In the 6 cases in which shoulder-joint amputation was done, 1 died of the operation and the remaining 5 all died within four to ten months. Of the 3 in which excision was performed 2 were lost sight of. The third is the case of Dr. Blake, of Boston, which I have already reported at length in the present paper. The head of the bone was excised, but it was thought certain that some of the tumor was left behind and the patient was immediately put upon the toxins; she is now well, more than nine years after.

In 3 cases the mixed toxins were used after operation, twice after amputation, once after excision. The 2 cases in which the toxins were used after amputation were treated by myself, and in both cases the toxins failed to check the return of the disease or to prevent a fatal issue. Yet, the fact that the only cure in the entire series of 13 cases (Blake's) was undoubtedly due to the toxins, is sufficient to justify the use of the toxins after operation. In only 1 case did I use the toxins before operation with the hope of saving the arm. In this case a very rapidly growing sarcoma of the humerus in a girl of thirteen, the tumor decreased in size during the first ten days, but soon began to increase again until, at the end of three weeks, I urged amputation; but the family would not consent and took the patient from the hospital.

The most complete data as regards the end results of operations for sarcoma of the humerus are found in the exhaustive paper of Jeanbrau and Riche (*Rev. de Chir.*, 1905, No. 8). These authors have collected 125 cases in which the interscapulo-thoracic amputation has been performed for tumors of the humerus, clavicle and scapula.

Sixty-four of these amputations were performed for malignant tumors of the humerus, with only 2 deaths. Fifteen, or 23 per cent. of these patients, were well from three to sixteen years.

Two of the cases, although classed as sarcomas, must be excluded, as 1 (Berger, seven years) was a myxoma and the other (Berger, sixteen years) an enchondroma. One died seven years after the first operation of generalization after three operations had been performed for local recurrence.

While these statistics show 20 per cent. of cases well beyond the three-year period, they can by no means be taken as an accurate index of the curability of sarcoma of the humerus treated by amputation. They have been collected from the medical literature of all countries, mostly from individual reports and, doubtless, the complete or partial success of the operation has had much to do with the publication of many of the cases. There have probably been many cases of failure which have not been reported.

Sarcoma of the Tibia.—With exception of the femur, the tibia is more frequently affected than any other of the long bones; the fibula much more rarely. The upper end of the tibia is the common site of origin. The disease is more often of central origin and of the giant-celled type. It is much less malignant than sarcoma of the femur and runs a slower course. Here, as in the femur, the joint is not affected in the early stages; and in cases of central origin, when all but a thin outer shell of the bone has been destroyed by the advancing growth, the characteristic egg-shell-crackling sensation may be elicited on pressure.

I have observed 13 cases of sarcoma of the tibia and 2 of the fibula. The ages of the patients ranged between seven and fifty-four years; 6 were under twenty years; 9 of the 15 under thirty years of age. The age of the fibula patients was fifty-four years in each instance. Nine of the cases were females and 6 males.

The location of the tumor in my series was more variable than is usually seen according to other writers. In 6 cases it

was in the middle, in 3 at the lower end, in 4 at the upper end.

Methods of Treatment.—Amputation above the knee was performed in 6 cases, without mortality. Amputation was advised, but refused by the patient, in 6 cases. Excision was performed in 1 case, and the mixed toxins were used before amputation in 2 cases.

Results.—Of the 6 cases in which amputation above the knee was done, 1, operated upon by myself ten years ago, still remains well; 1, operated upon by Dr. McBurney in January, 1894, died seven months later of metastases; 1 developed pleural and general metastases in four months, with death in six months; 1 was not traced; 1 had pleural and lung metastases five and a half years after amputation (Bull) with death six months later; 1 (fibula) lived two years and then died of lung metastases. In short, of the 6 cases amputated above the knee, only one was permanently cured.

Of the remaining cases, 1 in which excision was twice done for sarcoma of the lower end of the tibia with immediate recurrence after both operations, was then treated with the mixed toxins of erysipelas and bacillus prodigiosus. The X-ray was also used in conjunction with the toxins and the treatment kept up for nearly six months. The tumor disappeared and the patient is still well, nearly two years later.

In another case of sarcoma of the middle third of the tibia, recurrent after operation, I decided to use the mixed toxins before sacrificing the limb. The toxins were begun in February 1899, and continued for two to three months, with the result that the tumor entirely disappeared, and the patient is still in good health, working upon his farm in Chesley, Ontario.

The other cases in which operation was refused have not been traced. In 1 other case, a sarcoma of the fibula, the toxins were used before amputation without controlling the disease, and then amputation was performed. The patient died two years later of lung metastases.

Sarcoma of the Radius and the Ulna. Five cases: three of the Radius, and two of the Ulna.—Sarcoma of the ulna is so extremely rare that the following cases are given in detail.

Butlin states that not a single case of sarcoma of the ulna has been observed at St. Thomas' Hospital in fifteen years:

CASE V.—*Sarcoma of Ulna*.—D. J. S., 25 years. F. H. good. On December 8, 1898, Dr. George Tully Vaughan amputated the right arm in the lower third for sarcoma of the ulna. The patient at that time gave a history of having had a "greenstick" fracture of the right ulna three years before, from which he recovered. Two and a half years later, the bone began to enlarge at the site of the fracture, and about three months later, the bone broke at this point as a result of throwing a stone or cob. Examination at that time (three years after the "greenstick" fracture), showed a spindle-shaped enlargement of the middle of the right forearm, the circumference being $1\frac{1}{2}$ inch larger than the left. The surface temperature was distinctly higher than on the left forearm. The swelling was firm, semi-fluctuating, not tender, except at a point on the border of the ulna where motion and crepitus were felt. A skiagram showed a fracture of the ulna in the middle third and a mass springing from the upper border of the ulna and extending towards the radius. Subsequent exploratory incision showed this mass to be soft, like granulation tissue, attached entirely to the interosseous border and mainly to the upper fragment. A piece was removed for microscopical examination which was made by Drs. Kingdon and Sprague, who pronounced it round-celled sarcoma with a few spindle cells. The patient made a good recovery and remained well until February, 1906, when he noticed an increase in the size of his abdomen, but as he had no pain or discomfort from this swelling, he paid no attention to it. In the beginning of October, he began to have pain and consulted Dr. J. W. Perkins of Kansas City, Mo., who referred him to me. Physical examination made by me on October 29, showed the patient to be well nourished, having apparently not lost any weight, although he looked slightly anæmic. Right arm was absent; there was no local recurrence nor were there any signs of a return of the disease in the axilla. Examination of the abdomen showed the same markedly protuberant, but symmetrically enlarged. Palpation showed the abdomen filled with an enormous tumor, extending from the ensiform cartilage nearly to the symphysis pubis. The intestines are pushed over to the left side. Several large masses, each the

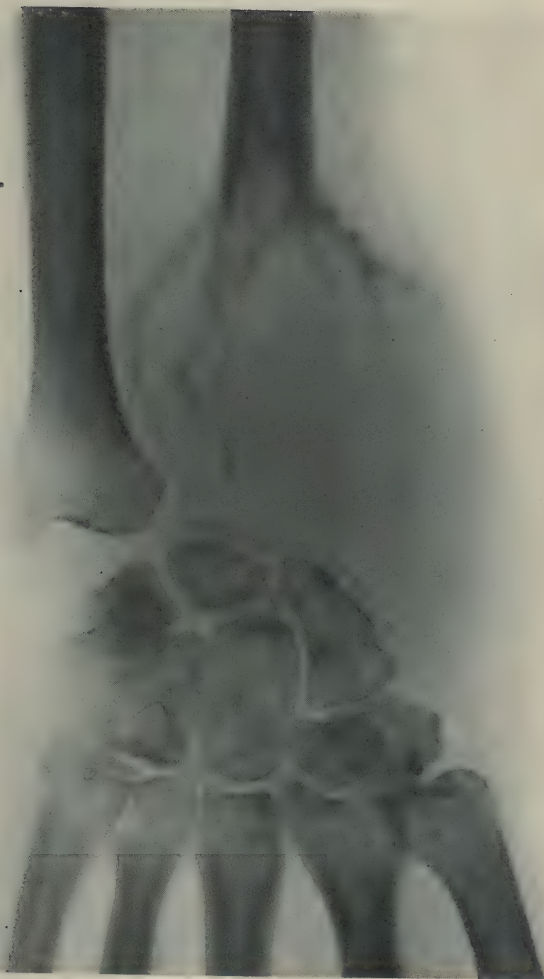


FIG. 10.—Sarcoma of the radius.



FIG. 11.—Sarcoma of the radius (Coley). Amputation, and mixed toxins after operation.

size of a child's head, more or less independent from one another, can be made out. They seem to start in the retroperitoneal glands, and be pushing forward. There was no ascites.

The patient was put upon the mixed toxins in November, 1906, with little hope of doing him much good, but at the end of one month's treatment the masses in the abdomen had decreased in size so much that the circumference at the umbilicus was 5 inches less than when the toxins were begun. He is still under treatment.

February 8, 1907.—The tumors are less than one-third the size at the beginning of treatment three months ago. He is steadily gaining in health.

The second case I owe to the courtesy of Dr. P. W. Nathan, who has given me the privilege of publishing it. I had arranged to see the patient in consultation, but death occurred in the interval.

CASE VI.—*Sarcoma of Ulna*.—H. F., 24 years, married; one child; never sick since child was born. In December, 1905, while scrubbing, she knocked the inner side of the right arm against the pail. The arm felt sore for a few days, then was apparently well. About a month later she began to have pain in the arm at the site of the injury and noticed a slight swelling. Both swelling and pain increased. The pain became constant and often kept her awake at night. She soon became emaciated and was slightly cachectic in March, 1906, when Dr. P. W. Nathan saw her. The swelling in the lower end of the right ulna was about the size of a small peach, apparently involving the whole circumference of the ulna. The tumor was hard and smooth and the soft parts were fully movable over it. Wrist and elbow joints apparently normal; tumor not particularly painful on pressure. Amputation was advised, but declined. When seen again by Dr. Nathan, in November, 1906, the tumor was about the size of a small baby's head, extending almost to the wrist at one end and the middle of the shaft at the other; the glands in the axillary and cervical regions were markedly enlarged. There was also a small tumor in the lower end of the sternum and she complained of pain in the back. The spine was stiff in the lower dorsal region. She had œdema of the lungs; heart sounds were very

weak and the patient was extremely emaciated. She died the following day. These two cases show the strong tendency to metastases in sarcoma of the ulna.

Sarcoma of the Metacarpal and Metatarsal Bones.—Sarcoma of the metacarpal or metatarsal bones is very rare, and the former even rarer than the latter. In my list of 615 cases only 3 cases of sarcoma of the metacarpal bone have been observed, and in only 1 of these was the disease primary in the metacarpal bone. This case was one of acute traumatic malignancy, the tumor appearing in a perfect healthy, robust young lady, immediately after a blow upon the back of the hand. It was treated at first as acute periostitis, later, as probable tubercular osteitis. At the end of four months, at which time there was marked thickening of the periosteum as well as metacarpal bone itself, a specimen was removed and microscopical examination proved it to be an alveolar round-celled sarcoma. Immediate amputation at the middle of the forearm did not prevent the appearance of metastases in both breasts in four weeks' time, and death from general metastases, especially in the abdominal and thoracic regions, six weeks later. The early diagnosis in this case was very difficult. Intense pain and tenderness closely simulated an inflammatory trouble, especially as it immediately followed an injury. The failure to find pus in this case, continuation of severe pain, the rapid enlargement of the diffuse swelling of the metacarpal bone with the absence of any tuberculous history, should have made the probable diagnosis possible. In every case of doubt, of sarcoma in either the metacarpal or metatarsal bone, a small portion of the growth should be promptly removed for microscopical examination.

These tumors are exceedingly malignant and temporizing is fatal.

Sarcoma of the metatarsal bones is usually mistaken in the early stages for either acute rheumatism or tubercular

arthritis. My own case had been treated for several weeks for acute rheumatism. The diagnosis should have been made from the following points:

(1) The very severe pain, limited in a single, limited area, rather in the bone itself, than along its articular surfaces; (2) the absence of any effusion about the joint and the fact that no other joints or bones were affected; (3) the fact that neither pain nor swelling were affected by large doses of salicylate; (4) the absence of fever; (5) the gradual but constant increase in size.

The diagnosis from tuberculosis could be made from the fact that the patient was a strong, healthy young woman, 26 years of age, who had no family or previous personal history of tuberculosis. The character of the swelling itself differed from that usually found in tubercular osteitis. The swelling was more diffuse, situated near the centre rather than the extremities of the metacarpal bone. There was no inflammatory redness, no adhesion nor caseous degeneration. Again, the pain was much more severe than I have ever witnessed in connection with tubercular osteitis. Amputation of the leg was performed in this case at the junction of the lower and middle third. The patient was put upon the mixed toxins of erysipelas and bacillus prodigiosus immediately after wound healing and the treatment kept up for about four months. I examined her in November, 1906, five years later, and found her in perfect health.

There are two cases in the tables which deserve further notice; they are:

FIRST (Case XXXVI). *Sarcoma of the Femur*. C. C. S., male, aged 42 years, seen in consultation with Dr. L. S. Pilcher in May, 1905. About eight months prior to his admission to the hospital, he had pain in the region of the knee, following a slight wrench while skating. In a few months the pain disappeared and he remained well for ten months and then began to have a return of the pain, which was attributed to rheumatism. In December, 1904, sudden severe pain developed which compelled

him to go to bed; he remained in bed for two months, then was up and about on crutches for three months. There was no limitation of motion in the knee joint, but a tumor developed in the region of the condyles. This gradually increased in size and in May, 1905, Dr. Pilcher removed a portion of the tumor for microscopical examination. The specimen was examined by Dr. Biggs of New York and several pathologists of Brooklyn, all of whom concurred in confirming the clinical diagnosis of sarcoma. Hip-joint amputation was strongly advised both by Dr. Pilcher and myself, but the patient would not give his consent. He left the hospital, and shortly afterward began taking internal "herb medicines" which he obtained from an advertising clairvoyant physician. He soon began to improve, and after a few months was able to walk. Personal examination January 10, 1907, shows a cicatrix 3 inches long and $1\frac{1}{2}$ inches wide over inner condyle of left femur. The femur seems perfectly normal in appearance and the knee-joint movements are normal. Measurement over the condyles shows one-half inch larger than on the other side, but patient states his right knee has always been swollen, due to hip disease when a child. The patient's general health is good and he walks two or three miles a day without a cane.

SECOND (Case XXI). *Periosteal Sarcoma of the Femur.* Miss R., aged 18 years, examined by me on February 15, 1901, in consultation with Dr. Geo. R. Fowler of Brooklyn. The patient had been treated for several weeks for pain and swelling in the middle of the right thigh. Examination showed a swelling, apparently of bony origin, in the middle of the right thigh, fusiform in shape, somewhat tender on pressure. An exploratory operation was performed at the German Hospital in Brooklyn, by Dr. Fowler, who found a tumor 2 to 3 inches in length, situated on the outer aspect of the middle of the right femur, starting apparently from the periosteum. Examination was made by the hospital pathologist, who pronounced it round-celled sarcoma. Hip-joint amputation was advised by Dr. Fowler and myself, but in this case also, the patient and family refused to give their consent. The patient left the hospital and soon began taking some vegetable medicine. The trouble promptly disappeared and she remains perfectly well up to the present date.

Dr. Fowler and myself endeavored to obtain a slide of the

specimen for further examination, but both specimen and slide had become lost and we were unable to confirm the diagnosis.

In view of the short duration and the limited extent of the disease, and the fact that the temperature ranged between 101° and 102° , with considerable pain and tenderness, there is very little doubt that we were dealing with a periostitis rather than a true neoplasm. It would be unfair, however, not to include these two cases, inasmuch as they both fulfilled the test ordinarily applied and accepted as sufficient in such cases, and had amputation been performed, as was advised, we should have had the unquestioned right to class them as operative cures. In the first case I believe the diagnosis was correct, and that the simple exploration with more or less curetting was in the early stage of the myeloid sarcoma sufficient to produce a cure. I have had one case of sarcoma of the lower jaw (myeloid) in which a preliminary operation with curetting resulted in a cure. Such cases furnish strong reasons in favor of the more conservative operations in the myeloid type of sarcoma of the long bones. The other case, I believe, was a case of mistaken diagnosis. Another explanation is that these two cases may have been instances of spontaneous cure. We know that carcinoma in mice shows spontaneous disappearance in many cases, as high as 20 per cent. in some laboratories, and Gaylard has collected about 20 cases of spontaneous cure of carcinoma in man. Dr. Beebe's experiments at the Huntington Fund for Cancer Research show a certain proportion of spontaneous recoveries in sarcoma in dogs, and there is reason to believe the same thing may occur in sarcoma in man, though such cases must be exceedingly rare.

(See Tables I to IV, page 360, et seq.)

FINAL RESULTS.

Ten patients have remained well over three years. One patient with sarcoma of the femur was well five years after hip-joint amputation; 1 of the femur, well after five years, no oper-

ation, medicinal treatment,—diagnosis in this case was probably erroneous; 1, a subperiosteal round-celled sarcoma of the femur with metastases, well after five years, treated with the toxins, without operation; 1 of the tibia remains well eight years after treatment with the mixed toxins, without operation; 1 of the tibia, well ten years following amputation of the thigh; 1 of the tibia, well five and a half years after, then developed metastases in the lung; 1 of the tibia, well two years after, recurrent twice after conservative operation, the tumor disappeared under the toxins and X-rays, patient well at present; 1 of the humerus, well after four years after resection, followed by the mixed toxins; 1 of the radius, well six years after resection; 1 of the ulna, well eight years, then developed extensive abdominal metastases; 1 of metatarsal bone, well five years, amputation of leg, middle and lower third, mixed toxins after operation, four months.

The method of treatment that I would propose as a substitute for the present methods is one that I have been gradually forced to adopt by steadily accumulating mass of evidence in its favor.

As early as 1895, in a case of sarcoma of the fibula, I attempted to save the limb by injections of the erysipelas and bacillus prodigiosus toxins. Although there was some slight improvement, this proved to be only temporary, and three months later I amputated above the knee. The patient died of lung metastases two years later.

In 1899, in a case of sarcoma of the tibia, which had been twice treated by local operation, curetting and chiseling, I again attempted to save the limb before resorting to amputation. This time with better result, as may be seen from the following history of the case:

Spindle-Celled Sarcoma of the Tibia.—F. W. F., male, ætat 27 years, farmer by occupation. F. H. good. No tubercular or syphilitic history. In March, 1897, the patient first noticed a swelling over the middle region of the left tibia. This became

red and gradually increased in size. On November 25, 1898, an exploratory operation was done by Dr. Stewart of Toronto, Canada. The tissue removed was examined by Dr. John Caven, Professor of Pathology at the University of Toronto, who pronounced it spindle-celled sarcoma. Amputation of the leg had been advised. In February, 1899, the patient was referred to me by Professor Caven in the hope of saving the limb by the use of mixed toxins. He was admitted to my service at the General Memorial Hospital. Examination at this time showed a tumor, anteriorly, in the middle portion of the left tibia 3 x 4 inches in size, projecting $\frac{1}{2}$ to $\frac{3}{4}$ inch above the normal surface. There were two areas of ulceration, the larger being 1 inch in diameter; no enlarged glands could be detected. The patient was put upon the mixed toxins of erysipelas and bacillus prodigiosus and the injections were continued for about two months. At the end of this time the tumor had apparently disappeared and the ulcerations began to fill up with healthy granulations. During his stay at the hospital he had an attack of accidental erysipelas which he undoubtedly contracted from a patient in the ward suffering from erysipelas. The disease extended over the entire leg and thigh and the attack, which was quite severe, lasted for about two weeks. The ulcerations quickly healed up and the patient returned to his home and has been pursuing his regular occupation up to the present time. His health is perfect and he has had no trace of a local or general return of the disease.

Myelosarcoma (Giant-Celled) of Tibia.—K. K., female, 17 years of age. F. H. good; P. H. first noticed pain in ankle in the early part of 1904; then a swelling appeared over the internal malleolus which was painful on pressure. She went to several clinics but got no relief; the trouble was looked upon as tuberculous disease. In September, 1904, she was unable to walk. A large swelling appeared over the internal malleolus, with slight effusion into the joint. October 11, 1904, she was operated upon at the Hospital for Ruptured and Crippled by Dr. V. P. Gibney. A $2\frac{3}{4}$ inch incision was made and 8 ounces of thick, reddish-brown soft material was removed from the lower end of the tibia. The entire lower third of the tibia was apparently involved, only a thin outer shell remaining; fibula and ankle joint were apparently not involved. Microscopical examination proved the tumor to be myelosarcoma (giant-celled). A large local recurrence took

place and on January 3, 1905, this was curetted and the patient was put upon the X-rays and toxins. Thirty-two injections were given at the Hospital for Ruptured and Crippled, after which she was referred to the General Memorial Hospital, where she remained under treatment until July. The tumor which had recurred after operation seemed to be held in check by the treatment. Her general health improved and she returned to her home. Examination on November 20, 1906, showed the patient in perfect health, walking without cane or crutch.

I had not yet reached the point of advising the toxin treatment in cases of periosteal sarcoma of the femur, because of the extreme malignity of the disease and the possibility of metastases occurring during the period of trial with the toxins. Hence, in these cases I still advised hip-joint amputation in spite of the uniform failures this method had hitherto given me.

In 1902, however, a patient, 19 years of age, was referred to me by Dr. W. R. Townsend, of the Hospital for Ruptured and Crippled, with periosteal round-celled sarcoma involving the lower two-thirds of the femur. Both the patient himself and his family absolutely refused to consider amputation, so that I felt justified in this case to suggest a trial with the toxins. The following is a brief history of the case:

Round-Celled Sub-periosteal Sarcoma of the Femur, Involving Lower Two-thirds of the Shaft.—A. G., 19 years. A tumor in the lower portion of the femur was first noticed in November, 1901. There was no history of trauma. This tumor gradually increased in size and was accompanied by loss of weight and deterioration of general health. The patient was referred to me on February 5, 1902, by Dr. W. R. Townsend of the Hospital for Ruptured and Crippled. Physical examination at that time showed a large tumor, occupying the entire lower two-thirds of the left femur, fusiform in shape and most prominent in the region of the condyles. On the outer aspect of the thigh, about $1\frac{1}{2}$ inch above the joint, there was a soft fluctuating area. There was slight impairment of the functions of the joint, but the joint itself was not involved. An incision was made under ether anæsthesia over the fluctuating area and 3 ounces of clear serum,

similar to that found in sarcoma of the bone which has undergone cystic degeneration, was evacuated. By means of a curette a considerable portion of typically sarcomatous tissue was removed. This was examined microscopically by Drs. E. K. Dunham of Bellevue Hospital and B. H. Buxton of Cornell University, and pronounced small, round-celled sarcoma. The patient absolutely refused amputation at the hip joint, which I strongly urged.

I was at this time just beginning to try the X-ray treatment of inoperable malignant tumors, and gave the patient four exposures a week. At the end of one month the tumor had decreased in size one inch. The treatment was continued during the entire summer and fall of 1902. The patient gained considerably in weight, but in December, 1902, developed a metastatic tumor in the left pectoral region. This grew very rapidly, and when it had reached the size and thickness of the hand, I removed it with scissors and curette, under ether anæsthesia. Shortly after this, a large tumor, about the size of a child's head, developed in the iliolumbar region on the right side; it filled up the whole iliac fossa and extended up to the ribs. I then put the patient upon large doses of the mixed toxins of erysipelas and bacillus prodigiosus. After about four weeks the tumor in the iliolumbar region began to soften and break down. As soon as fluctuation became distinct, I made a posterior opening and evacuated a large amount of necrotic tumor tissue. A tube was kept in place and the sinus drained for about a year. No X-ray treatment was applied to the iliolumbar tumor. The sinus in the leg has persisted up to the present time; examinations of several curettings have failed to show any evidence of sarcoma. At the present time, five years from the beginning of the treatment, and four years since the toxins were begun for the metastatic tumors, the patient has remained in apparently perfect health and there is no longer any evidence of sarcoma to be found.

Up to the present time I have been able to collect 12 cases of sarcoma of the long bones: 3 personal cases and 9 reported by other observers, in which the use of the toxins has rendered amputation unnecessary and the limb has been saved.

In 8 of these cases the sarcoma was of the round-celled variety, in 2 spindle-celled and in 2 no microscopical exam-

ination was made, but amputation had been strongly advised in both instances by prominent surgeons.

The period of observation in these cases is most important: 8 were alive and well and free from recurrence from three to eight years, 1 two years, 1 one year; 2 other cases have been observed less than six months.

In 5 of these cases the tibia was involved; in 1 the fibula; in 3 the femur; in 1 the radius; in 1 the humerus (not long bone). In every one of these amputation had been seriously considered, but it was thought justifiable to give the toxins a trial before resorting to operation.

These cases seem to me sufficient in number and the period of observation sufficiently extended to justify us in advocating a course of treatment with the mixed toxins in practically all cases of sarcoma involving the long bones before sacrificing the limb.

It is important to note that in several of these cases, particularly the two cases of sarcoma of the femur, involving the upper end, the disease was so extensive that hip-joint amputation was impossible. In both of these cases the diagnosis had been confirmed by microscopical examination.

If we could offer the patient reasonable certainty of life by amputating the limb, there might be some ground for hesitating to try the toxin treatment before amputation; but, in the face of our inability to save the life of the patient except in a very small minority of cases, I feel that we are risking little in giving the patient the benefit of a brief trial with the mixed toxins. A period of three to four weeks will almost always be sufficient to determine the probable success or failure of the treatment. If a tumor continues to increase in size during this period, then I would not prolong it to the full four weeks, but would amputate at once, and then as soon as practicable continue the toxins as a prophylactic against recurrence. With this important exception I would limit the use of the toxins to *inoperable* sarcoma, which has always been my custom in the past. About 10 to 12 per cent. of such cases hopeless from any other standpoint, have been successful.

The use of the toxins is no longer in the experimental stage, as I have attempted to show in my paper, loc. cit. (*Amer. Jour. Med. Sci.*, March, 1906). In this paper I gave the records of 36 personal cases of inoperable sarcoma in which the toxins have been used with success during the last fourteen years. Twenty-six of these cases were well and free from recurrence from three to thirteen years; 21 from five to thirteen years. The same paper contains a tabulated report of 60 cases successfully treated by other surgeons, 27 of which were alive and well from three to twelve years, which is sufficient refutation, I think, of the statement occasionally made, that the method has been successful only in the hands of its author.

The toxins used in my personal cases since 1894 up to a year ago have been prepared by Prof. B. H. Buxton, of the Loomis Laboratory (Cornell University Medical School). During the last year the toxins have been prepared by Dr. Martha Tracy, of the Huntington Cancer Research Fund, under Dr. Buxton's direction. Dr. Tracy has, I think, made an improvement over the older method of preparation, which consisting in growing the bacillus prodigiosus in the same bouillon with the streptococcus of erysipelas. The growth of the prodigiosus was always variable and it was difficult to get a standard preparation. Dr. Tracy has, during the last year, grown the prodigiosus separately, sterilized with just sufficient heat to destroy the bacilli, reducing the growth to a dry powder and then adding a certain definite amount by weight to each ounce of the streptococcus broth. This preparation is much more stable and has proved somewhat more powerful in its action, requiring smaller doses, and the actual results in inoperable sarcoma thus far have shown a distinct improvement over those obtained with the older preparation. My own clinical experience, apparently confirmed by Dr. Tracy's experiments upon sarcoma in dogs, has proven that the bacillus prodigiosus itself exerts a powerful inhibitory action upon the growth of sarcoma, although I originally added it to the erysipelas with the sole idea of intensifying the action of the streptococcus of erysipelas.

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I. SARCOMA OF THE FEMUR.

Case.	Date.	Sex.	Age.	Locality.	Duration.	Trauma.	Variety.	Treatment.	Result— Immediate.	Result— Final.
1	1896	F.	11	Lower third. Periosteal.	8 months.	Yes. Fell down steps, injured knee.	Spindle celled.	Hip joint amputation. (Coley.)	Recovery.	Not traced beyond 6 months.
2	1897	F.	13	Lower third. Central.	8 months.	No trauma.	Round sarcoma.	Hip joint. (Coley.)	Recovery.	Died of metastasis in 1½ years.
3	1897	M.	6	Lower half. Periosteal.	6 months.	No.	Round celled.	Hip joint. (Coley.)	Recovery.	Death. Lung metastasis, 6 months.
4	1898	M.	44	Lower third. Central.	2 to 3 months.	Yes. Fracture from kick of horse.	Round celled.	Hip joint. (Coley.)	Recovery.	Death. Lung metastasis, 8 months.
5	1901	F.	50	Upper third. Periosteal.	6 months. Excision. Recurrence.	No.	Round celled. Central.	Hip joint. (Coley.) Toxins 6 weeks after operation.	Recovery.	Death. Metastasis, 8 months.
6	1904	M.	28	Lower third. Central.		Yes.	Round celled.	Amputation upper third. Recurrence in stump. Hip joint. (Coley.)	Recovery.	Toxins after operation. Recurrence. Death, 6 months.
7	1899	F.	8	Lower half. Periosteal.	4 months.		Round celled.	Hip joint. (Bull.)	Recovery.	Death. Metastasis, 6 months.
8	1898	F.	13	Lower third. Myelogenous.	7 months.	No.	Round celled.	Hip joint. (Rushmore.)	Recovery.	Well 5 years later.
9	1897	M.	25	Lower third. Periosteal.	3 months.	Yes.	Round celled.	Hip joint. (Bull.)	Recovery.	Recurred. (Toxins.) Metastasis. Death, 1 year.
10	1905	M.	15	Lower third. Periosteal.	4 months.		Round celled.	Hip joint. (Johns, Markoe.)	Recovery.	Toxins after operation, 3 months. Recurrence. Death, 1 year. Metastasis.
11	1902	M.	16	Lower third. Periosteal.			Round celled.	Hip joint. (Roosevelt Hospital.)	Recovery.	Recurrence. Local toxins. Not traced.

12	1901	M.	45	Middle, osteal.	Peri-	3 to 4 months.	No.	Spindle celled.	High amputation (Coley) followed by toxins. Later hip joint. (Bloom.)	Recovery.	Recurrence. Death, 2 years. Metastasis.
13	1896	F.	26	Lower third. Central.	3 months.	Yes. Strain.		Mixed celled.	High amputation. (Coley.)	Recovery.	Death 4 months. Metastases of lungs.
14	1906	F.	20	Lower third. Central.	1 year.	No.		Round celled. Giant celled.	Amputation below trochanter. (Coley.)	Recovery.	Toxins after operation. Gain 39 pounds. Well February, 1907. 9 months.
15	1906	F.	16	Lower third. Central.	3 months.	No.		Round celled.	Amputation below trochanter. (Coley.)	Recovery.	Toxins after operation. Gain 30 pounds. Well February, 1907. 9 months.
16	1906	F.	13	Lower third. Central.		No.		Round celled.	Amputation below trochanter. (Whitman Gallie.)	Recovery.	Toxins after operation. Well at present. February, 1907.
17	1903	M.	43	Lower third. Periosteal.	6 months.	Yes. Fall, few months before.		Round celled.	Amputation, hip joint.	Recovery. Recurred in six months in stump.	Recurrence. Treated with toxins 3 weeks, no effect. Died later. About 6 months.
18	1906	M.	32	Lower third. Central.	6 months.	No trauma.		Round celled.	Amputation below trochanter. (Erdman).	Recovery.	Toxins begun 2 months after operation. No recurrence at present.
19	1901	M.	50	Upper third.	6 months.	Yes.		Round celled.	Exploratory operation 1902.	Too extensive for amputation.	Toxins for few weeks. Little effect.
20	1902	M.	16	Lower third. Periosteal.	4 months.	No.			Amputation advised. Refused.	None.	Not traced.
21	1901	F.	18	Middle, osteal.	6 weeks.	No.		Round celled.	Hip joint amputation advised. Refused. Took some vegetable medicine from a "cancer specialist."	Recovery.	Well at present, 5 years later. (Diagnosis doubtful.)

I. SARCOMA OF THE FEMUR.—Continued.

Case	Date.	Sex.	Age.	Locality.	Duration.	Trauma.	Variety.	Treatment.	Result— Immediate.	Result— Final.
22	1906	M.	38	Upper third. Central.	6 months.	Yes.	Round celled. Giant celled.	Tumor extended into groin and iliac fossa. Inoperable. 7 inches larger than other site. Mixed toxins October 21, 1906. (Foote.)	Rapid improve- ment. Large masses of tumor slough- ed out.	Tumor nearly disap- peared. November 21, 1906. Patient gradu- ally grew weaker and died early in Decem- ber, 1906.
23	1905	M.		Lower third. Periosteal.	5 years.	No.	Round celled.	Amputation below tro- chanter. (Bull.)	Recovery.	Metastasis in face and head 4 months later. Died 7 months after operation.
24	1891	F.	16	Lower third. Pe- riosteal.	1 year.		Round celled.	Inoculated with living cultures of erysipelas; could not produce an attack.	Rapid progress of disease.	Death. 4 months. Ex- haustion.
25	1894	F.	21 mos.	Upper end involv- ing ilium.	6 weeks.		Round celled.	No treatment.		Death. 3 months.
26	1902	F.	25	Middle third. Myeloid.	6 months.	No.	Round celled. Myeloid.	Too far advanced for amputation. Toxins a few weeks.	Little effect.	Death.
27	1895	F.	22	Lower end. Pe- riosteal.			Round celled.	Hip joint amputated. (Walker.)	Recovery.	Not traced.
28	1905	F.	13	Lower end.	4 months.	Trauma.	Round celled.	Too far advanced for hip joint operation. Toxins for 4 weeks.	Slight improve- ment.	Not traced.
29	1902	M.	18	Lower two thirds	6 months.	Yes.	Round celled.	Amputation hip joint advised. Refused. X-ray followed by metastases. Toxins then used.	Recovery. Tu- mors in leg, pectoral and ilio-lumbar regions disap- peared.	Well February, 1907. Four and one half years.

30	1898	F.	19	Upper end. Central.	9 months.	No trauma.	Round celled. (Giant.)	Tumor inoperable. Ex- ploratory incision. Specimen removed for microscopic ex- amination.	Toxins (Els- burg). Two to three months. Ar- senic injections.	Final recovery. Union of the spontaneous fracture. Well six years later.
31	1906	F.	34	Upper third.	6 months.	No.	No microscopic examination.	No operation. Toxins. May, 1906.	Improvement.	Still under treatment.
32	1906	M.	10	Middle fusiform. Periosteal.	5 months.	No.	Periosteal; Small round celled.	Exploratory incision. Nov. 27, 1906.	Put upon mixed toxins at once.	Under treatment. Feb. 1907. Marked decrease in size; gaining weight.
33	1904	M.	15	Lower third. Periosteal.	Developed few days after fall.	Yes. Fall upon knee. Few days.	Round celled.	No operation. Toxins short time.	No marked improvement.	Not traced.
34	1901	M.	23	Lower end. Periosteal.	1 year.	Yes. 1 year after injury. Fall.	No microscopic examination.	No treatment. Amputation advised.	Refused.	Not traced.
35	1905	M.	42	Lower end. Myeloid.	8 months.	Strain several months before.	Round celled.	Exploratory operation. Dr. Fitcher. Amputation advised. May, 1905.	Slow disappearance of growth.	Examination January 10, 1907. Fenur, normal appearance. No evidence of tumor present. (<i>vid. text.</i>)
36	1907	M.	12	Middle and lower third.	3 weeks.	Kick. Developed 1 week after.	Round celled.	Exploratory operation January 15, 1907. Dr. W. R. Townsend.	Put on mixed toxins Jan. 17, 1907.	Decreased $1\frac{1}{4}$ in. in 10 days. Feb. 10, 1907, beginning to increase in size. Amputation below trochanter, Feb. 15, '07.

II. SARCOMA OF THE TIBIA.

Case.	Date.	Sex.	Age.	Locality.	Duration.	Trauma.	Variety.	Treatment.	Result— Immediate.	Result— Final.
37	1907	F.	29	Upper tibia.	Second year.	Yes. Fall.	Round celled. Myeloid.	Exploratory operation. Jan. 17, '07. Dr. Gibney.	Toxins used to save limb.	Under treatment, Feb. 10, '07. Decrease in size
38	1895	F.	11	Middle tibia. Periosteal.	1 month. 3 inches increase in size.	Fall 3 months before.	Round celled. Very vascular.	Amputation urged. Refused. Toxins 4 doses only.	Lost sight of.	

II. SARCOMA OF THE TIBIA.—Continued.

Case.	Date.	Sex.	Age.	Locality.	Duration.	Trauma.	Variety.	Treatment.	Result— Immediate.	Result— Final.
39	1896	F.	24	Upper end. Central.	4 months.	Yes. Fall down stairs. Tumor very soon after.	Round celled. Small round.	Amputation 1895. (Coley.) Lower third thigh.	Recovery.	Well 10 years after.
40	1899	M.	27	Middle and upper third. Tibia.	1 year and 11 months.	No trauma.	Spindle celled. Periosteal.	Mixed toxins of ery- sipelas and B. pro- digiosus, 2 months.	Tumor entirely disappeared.	Patient well at present, 8 years later.
41	1897	M.	12	Upper third. Tibia. Fusiform Periosteal.	1 month.	Fall. Develop- ed soon after few days.	Round celled.	Amputation of thigh. (Bull.) 1895.	Recovery.	Not traced.
42	1902	F.	17	Lower end. Tibia. Central.	6 months. Pain before swelling.	No trauma.	Round celled. Giant celled.	Two operations, Dr. Gibney, October 1904, and January 1905. Curettage and chis- eling out of bone. Rapid recurrence.	Put upon mixed toxins of ery- sipelas and B. prodigiosus with x-ray. Jan. 1905. (Coley.)	Treatment continued till July 1905. Tumor disappeared. Patient well January, 1907.
43	1906	M.	26	Lower two- thirds. Central.	34 years.	Yes. Cystic cavity. Lower half of tibia a shell.	Round celled.	Toxins 3 months, June, 1906. Tumor de- creased in size. Toxins. Much im- proved.	Much improved	Not traced.
44	1894	F.	35	Tibia. Middle.	6 months.	No trauma.	Spindle celled. Periosteal.	Amputation above knee. (McBurney). June 27, 1899.	Recovery.	Spinal recurrence; met- astasis. 7 mos. Death.
45	1904	M.	10	Tibia. Middle. Upper third.		Trauma. 1 year before.		Amputation advised. Refused.		Not traced.
46	1905	M.	20	Middle. Tibia.	4 years.	Trauma. Tum- or 3 inches larger than other side.		Amputation advised. Refused. March, 1905.		Not traced.

Local and general recurrence. Lung pleura and rib. 4 mos. Died Nov. 1906.

Not traced.

Metastasis, lung and pleura, 5 years and 6 months. Death 6 years six months. Toxins used after generalization; little effect.

Recovery.

Amputation of upper third thigh. May 1906.

Round celled.

Amputation above knee (Coley).

Round celled.

Amputation middle thigh. (Bull.) February 12, 1900.

Round celled.

Central.

Yes.

Yes.

Trauma. Fall 1½ years before.

1 year.

6 months.

Pain and lameness 1 year before trauma.

Middle. Central.

Lower end.

Upper end. Central.

32

50

26

M.

F.

F.

1906

1896

1900

III. SARCOMA OF THE HUMERUS.

Case.	Date.	Sex.	Age.	Locality.	Duration	Trauma.	Variety.	Treatment.	Result—Immediate.	Result—Final.
50	1900	F.	37	Humerus.	4 months.	No trauma.	Round celled. Periosteal. No giant cells.	April, 1900. Operation.	Recovery.	Recurred. 5 months.
51	1901	M.	17	Left humerus. Upper end.	6 months.	No trauma.	Round celled. Periosteal. No giant cells.	Exploratory incision and amputation of shoulder joint. Dr. Bull, May, 1901.	Recovery. Local recurrence 3 weeks.	Mixed toxins of erysipelas and B. prodigiosus begun and continued 3 months. Recurrent. Tumor disappeared. Died November, 1901, 5 months after operation. Metastasis.
52	1900	M.	18	Left fusiform. Right Humerus.	6 months. Glands of neck.	Trauma. Brick fell 3 stories. Tumor at once.	Round celled. Periosteal.	6 months after first noted. Amputation, Dr. George Fowler, March, 1900. Metastases few weeks later.	Recovery. Metastasis quickly followed with larger tumor in right humerus. Aug. 1900.	Died soon.

III. SARCOMA OF THE HUMERUS.—Continued.

Case	Date.	Sex.	Age.	Locality.	Duration.	Trauma.	Variety.	Treatment.	Result—Immediate.	Result—Finl.
53	1901	M.	45	Humerus, Right and left. Middle central.	2½ months. Spontaneous fracture.	No trauma.	Round celled. Central.	Amputation of shoulder (Dr. Bull), May, 1900	Recovery. Severe neuralgic pains in chest five weeks later.	Mixed toxins 5 weeks. Pain increased September 1, 1901. Spontaneous fracture of other humerus. Died October, 1901, 6 months after first symptoms.
54	1905	M.	14	Humerus. Left. Periosteal.	5 months. Very large.	None noted but was a football player.	Periosteal (x-ray photo). No microscopic examination.	Amputation advised but refused. Tried X-ray against advice.		Died February, 1906, 10 months from first symptoms.
55	1904	M.	28	Humerus. Left. Axillary glands. Periosteal.	4 months. Very large. Size of a child's head.	No trauma.	Periosteal. Round celled.	Amputation of shoulder, part of clavicle and scapula, February 5, 1904. (Coley.)	Recovery. Recurring three months later.	Mixed toxins tried. No effect. Spinal and general metastasis. Died June, 1904 (7 months).
56	1901	F.	38	Right humerus, upper end.		Strain.	Chondro-sarcoma.	Excision of tumor.	Recovery.	Not traced.
57	1899	M.	58	Left humerus. Upper end.	6 months.	Trauma, 1 month before.	No microscopic examination.	Amputation of shoulder joint advised. Refused.		Not traced.
58	1906	M.	22	Right humerus, Upper end. Periosteal.	4 months.	No trauma.	Round celled.	No operation.	No treatment.	Exceedingly rapid growth size of adult head in 4 months. Death 5 months from start. (Fide text and illustrations.
59	1906	F.	13	Upper end. Joint not involved. Periosteal.	3 months.	No trauma. Pain first, swelling soon after.	Round celled.	Preliminary use of mixed toxins, begun November 26, 1906. 3 weeks. Improved at first, later no control.	Amputation advised. Refused.	Patient left hospital on December 23, 1906.

60	1906	F.	25	Right humerus. Periosteal.	6 months.	No trauma.	Periosteal.	Amputation of shoulder advised. Operation performed by another surgeon. (Campbell.)	Death from shock.	
61	1897	M.	20 mos.	Left humerus. Nearly whole bone. Fusiform.	1 month.	No trauma.	Periosteal.	Very rapid growth. 3 times size other arm in one month. Veins dilated. Joint not involved.	Amputation refused.	Not traced.
62	1902	F.	Adult.	Right humerus. Round celled. Myeloid.	Pain and stiffness. 4 months.	Yes. Fall 9 months before.	Round celled. Myeloid.	Removed head of bone, tip of coracoid process, part of glenoid cavity. Dr. J. Eabst Blake of Boston.	Treated with mixed toxins after operation.	Patient shown by Dr. Blake at the American Medical Association, Boston, June, 1906. Well. 9 years.

IV. SARCOMA OF THE RADIUS, ULNA, AND FIBULA.

Case.	Date.	Sex.	Age.	Locality.	Duration.	Trauma.	Variety.	Treatment.	Result—Immediate.	Result—Final.
63	1898	F.	24	Radius. Lower third.				Operation advised. Refused.		Not traced.
64	1902	F.	29	Lower third. Right radius. No glands. Central.	8 months.	Blow. Pain 3 months later. 5 months tumor.	Round Celled. (Giant.)	First operation September, 1900 (Dr. Hibbs). Second operation, January, 1902. Recurrence. Amputation advised.		Patient alive and well at present. Examined by Dr. Coley, Nov. 28, 1906.
65	1906	F.	31	Radius, left, lower end. No glands. Periosteal.	1 year pain. 8 months tumor.	No trauma.	Round celled.	Amputation. (Coley). September 14, 1906. Mixed toxins, October 1, 1906, as prophylactic.	Recovery.	Well at present, Feb. 1907.

IV. SARCOMA OF THE RADIUS, ULNA, AND FIBULA.—Continued.

Case	Date	Sex	Age	Locality.	Duration.	Trauma.	Variety.	Treatment.	Result— Immediate.	Result— Final.
896	66	1906	M.	25	Ulna. Middle. No glands affected.		Yes. Green- stick fracture 7 years before. Slight swell- ing soon after. Gradual in- crease in size.	Spindle celled.	Amputation of middle arm, 1899. Vaughn, Washington, D. C.	Recovery. Well 7 years. Re- curred in ab- domen. Spring 1906, noticed abdomen increasing in size. No pain. Oct. 1906, whole abdo- men filled with tumors of various sizes. Put on mixed toxins Nov. 1906. Tumors nearly disappeared Feb., 1907.
67	1906	F.	28	Ulna. Lower end.		No.		No treatment.	Lung and pleu- ral metasta- sis.	Died in less than 1 year from beginning of symptoms.
68	1896	F.	52	Fibula. Upper end. Joint not involved. Peri- osteal.	Pain 3 years. Swell- ing 2 years.	Fibula. No trauma.	Spindle celled. Periosteal.	Toxins, 6 weeks. Tum- or decreased 1 inch. Later increased. Am- putation. (Coley), November, 1895.	Recovery.	Died of lung metastasis 2 years later.
69		F.	52	Fibula. Upper end. Not in- volved joint. Periosteal.	2 years.	Trauma. Fall. Tumor devel- oped 3 months later.		1898. Amputation ad- vised. Refused.		Not traced.
70	1890	F.	18	Third metacar- pal. Periosteal.	4 months.	Blow on back of hand. Tumor developed im- mediately after.	Metacarpal. Round celled. Alveolar.	Exploratory incision. Amputation middle forearm.	Recovery.	Metastasis, both breast and abdomen in 4 weeks. Died 8 weeks later.
71	1901	F.	25	Second metatar- sal bone. Reg- ion, periosteal.	Few months.	No.	Round celled.	Amputation. Leg, Middle.	Recovery.	Mixed toxins 6 mos. Patient well 5 years after operation.

SUCCESSFUL ANTERIOR THORACO-BRONCHOTOMY FOR A FOREIGN BODY IMPACTED IN THE BRONCHUS.

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THE literature of operations directed to the removal of impacted foreign bodies in the bronchi, at least such of it as is available to the writer, is exceedingly limited, both as to extent and detail. Such as could be found, dealt with the subject in an indefinite and unsatisfactory manner. In most of the cases cited, no attempt was made to indicate the site of the foreign body, the method of approach made use of, or the conditions which governed the operator in his choice of a method of attack.

The operation of choice has apparently been the more complicated posterior bronchotomy, the reason for which has been that there is less danger of pneumothorax. The few reports of anterior bronchotomy that the writer was able to find, led to the belief that the report of this case might be of interest.

History.—J. S., male, age 6 years, 9 months, about noon on August 5, 1904, while playing, inspired a small metal collar button of the type in common use by laundrymen, which he had in his mouth. He became very much frightened, ran into the house and began to cough. The cough lasted only a few minutes, and the family, thinking that he had swallowed the button, paid no more attention to it. About five o'clock he had a sudden severe paroxysm of coughing and became cyanotic. His mother shook him and the coughing ceased. The boy declared that he felt something move in his "neck." During the night he had several severe paroxysms, became cyanotic, and the dyspnoea was marked.

The next morning he was taken to the family physician,

Dr. G. M. Studebaker, who, after examination, referred the patient to me.

Examination on August 6, 1904, at 9 A.M., showed a fairly well developed boy. The respirations were easy, though slightly limited on the right side. There was some dulness on the right side, anteriorly and posteriorly. The respiratory murmur was very much diminished posteriorly, and almost absent anteriorly. The temperature, pulse and respiration were normal. There was neither cough nor tenderness. Examination of pharynx and larynx was negative. Fluoroscopic examination of thorax was also negative. A diagnosis of a foreign body in the right bronchus was made and operation advised. The parents took the boy home and at first refused operation, but during the night of the sixth his condition became so alarming, from great difficulty in breathing and paroxysms of coughing, with cyanosis, that they consented to an operation.

On admission to the Hamot Hospital on August 7, 1904, at 10 A.M., the temperature was $98\frac{4}{5}^{\circ}$, the pulse 104 and the respirations 22. Examination showed a total absence of respiratory murmur on the right side, no cyanosis, respirations easy, movement limited on the right side.

Operation August 7, 1904, at 10.30 A.M. Chloroform anæsthesia.

Through a low tracheotomy wound a large silver probe was passed and the obstruction could be felt in the right primary bronchus. An attempt was made to remove the button by the use of long dressing forceps, silver wire loops and a curette, but every effort failed to move or grasp it. It was discovered later that the small end of the button was directed downward and the large end was firmly imbedded in the bronchus, the mucous membrane being very much swollen. As it was impossible to remove the button in this manner, I decided to open the thorax.

During the operation on the thorax chloroform was administered through the tracheotomy wound which was held open by a silk suture passed through the wall of the trachea, the chloroform being dropped on gauze held a short distance from the wound.

A curved incision was made, beginning over the second rib just beneath the middle of the clavicle, and carried downward and inward to within an inch of the right margin of the sternum, thence outward to the level of the fifth rib an inch to the inner



FIG. 1.—Showing patient after recovery from thoraco-bronchotomy for foreign body in bronchus.

side of the nipple. The cartilages of the third and fourth ribs were cut about one-half inch from their sternal attachment and an osteoplastic flap made by breaking the third and fourth ribs. Through this opening good access to the lung was secured. The lung was found almost entirely collapsed, and the button could be palpated easily through the lung. There was a slight movement of the bronchus with the respiratory act; an assistant by hooking his finger under the bronchus controlled the movements easily. As it was impossible to roll back the overlying lung an incision about one-half inch in length was made with a scalpel through the lung into the bronchus. There was practically no hæmorrhage from the lung or bronchus. A pair of artery clamps, introduced through the incision, grasped the button and by a twisting motion it was removed. All of this was done with lung within the thorax. The lung and bronchus were dropped into place, no sutures being inserted. The thoracic wall flap was replaced and silkworm gut sutures were inserted through the muscles. No drainage was used and no fluid injected into the pleural cavity. The tracheotomy wound was closed with sutures, but on account of great emphysema of the cellular tissues about the larynx and neck, causing dyspnoea, which developed shortly after the operation was completed, a tracheotomy tube was inserted. The patient was in considerable shock before the operation on the thorax was begun and the opening of the pleural cavity did not apparently increase the condition. Normal salt solution was injected into a vein and the patient rallied slowly. There was intense tracheal irritation, and severe paroxysms of coughing often expelled the tracheal tube.

At 4 P.M. the temperature was 99°; pulse, 140; respirations, 26. At 8 P.M. the temperature was 102°; pulse, 160; respirations, 40. The dressings were saturated with a slightly blood-stained serous discharge. When these were changed it was noticed that with each inspiration there was an escape of air from the pleural cavity. On auscultation a distinct whistling murmur could be heard, coincident with inspiration, which was caused, probably, by the escape of air through the wound in the lung and bronchus. The next day the temperature varied from 100 $\frac{4}{5}$ to 102 $\frac{1}{5}$; pulse, 120 to 140; respiration, 36 to 48. A croup kettle was kept boiling under a tent over the bed and the paroxysms of coughing became less severe. Air no longer escaped from the thoracic wound. The right side of the thorax

was tympanitic, a whistling murmur being heard on inspiration, though not as distinctly as on the previous night. Over the base of the left lung there was slight dulness and breathing almost bronchial in character.

At the end of 48 hours the highest temperature was 101; pulse 116 to 128; respirations, 38 to 56. As the subcutaneous emphysema had disappeared, the tracheal tube was removed and the wound closed with adhesive straps. Healed on sixth day.

There was a gradual improvement in the pulmonary condition; the tympanitic area gradually decreased and the respiratory murmur returned. There was no infection of the pleura, the thoracic wall healing without incident.

On the tenth day the patient was taught to blow water from one bottle to another, and, with this exercise, the lung rapidly expanded. The respiratory sounds were normal on the date of discharge from the hospital, August 26, 1904.

Examination 18 months after operation showed a slight depression over the site of operation on the thorax, expansion equal and good, normal respiratory sounds.

The exact localization of the foreign body, made possible by the exploration through the tracheotomy wound, greatly facilitated the subsequent steps in the operation, the time that would have otherwise been spent in searching for the obstruction was saved to the patient. Unfortunately, too much time—over an hour—was expended in fruitless attempts at removal by way of the trachea. In any future cases where the foreign body was impacted below the bifurcation of trachea, I should do the tracheotomy with greater hope of ascertaining the exact location by that means than of being able to remove the obstruction. Had the button been in such a position that it would have been possible to grasp it with forceps it is questionable if the injury done the bronchus by forcible dislodgement would not have been more disastrous than the bronchotomy.

While it is dangerous to draw conclusions from one case, the fact that forty-eight hours elapsed between the inspiration of the button and its removal and that the patient apparently did not suffer from the delay, might suggest the advisability of waiting not longer than 48 hours for spontaneous delivery.

THE SURGICAL TREATMENT OF EMPYEMA.*

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FOUR different methods of operating upon empyema are usually described: First, aspiration or paracentesis; second, thoracotomy with or without resection of a rib; third, the Estlander or Schede operation; and, fourth, the Fowler-Delorme method of decortication of the lung. To these must be added one recently suggested by Dr. Joseph Ransohoff, of Cincinnati, in the *ANNALS OF SURGERY*, April, 1906, which is simply a modification of the last method. This he calls "Discission of the Pulmonary Pleura." It consists of "gridironing" the pulmonary pleura with many parallel incisions removed from each other about a quarter of an inch, and crossing these obliquely, or at right angles, with other parallel cuts.

Of the first two methods little need be said at this time. They are of use in recent cases where the lung is not permanently collapsed and bound down, and will, if the lung expands, as it frequently does in these early cases of operation, result in a prompt and satisfactory cure. The other three methods are intended for the chronic cases of empyema where the lung has collapsed, and where its expansion to fill the pleural cavity is impossible unless some method is adopted to allow the chest wall to fall in against the pulmonary pleura and become adherent to it, in order to close the suppurating cavity, or, as in the last two operations, the lung itself is made to expand so as to fill the suppurating space.

All these methods are based upon the idea that when the

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lung has once completely collapsed and become firmly fixed the pulmonary pleura has lost its expansibility, owing to inflammatory thickening, so that it will not allow a sufficient amount of re-expansion to permit the pulmonary and parietal surfaces to come into contact. It is now over fifteen years since I began to experiment on these cases in order to determine if there was not some way to bring about this complete expansion of the lung without extensive and mutilating operations upon the chest wall. In 1893, when Fowler and Delorme suggested their method, I discontinued experimental work for a short time and adopted the method of decortication, with the idea that this furnished the best solution of the problem. It was not long, however, before I was convinced that the difficulties attending the freeing of the lung from its pleural covering were so great, and the result following the attempt was so often unsatisfactory, that I took up again the experimental work.

Tillman has said that "if in cases of old empyemata the lung, in consequence of prolonged compression, is no longer capable of expansion, the abscess cavity in the thorax cannot completely heal and an empyemic fistula persists, as the rigid bony wall of the thorax does not yield to the cicatricial contraction. In the most severe cases the involved lung is found firmly contracted, the size of a fist, in the upper part of the pleural cavity. In these cases healing can only be secured by a sufficient resection of the ribs to enable the thoracic wall to yield and thus follow the cicatricial contraction." And Dennis, in his *System of Surgery*, also makes the statement that "in cases of empyema of long duration . . . the lung is fixed and cannot expand, the pleura is adherent and inelastic, and the chest is prevented from collapsing; and thus a cavity is permanently formed, the obliteration of which is necessary to effect a cure."

On the other hand, Forcheimer, in his recent work on the *Prophylaxis and Treatment of Internal Diseases*, says that "as a matter of fact we do not find the lung collapsed in opening the chest for empyema, simply because the lung is always

held by pleural adhesions"; but he does not say that frequently in these chronic cases we find the lung pushed up and held in the apex, as Tillman says, or else pushed inward and backward, and reduced to a ribbon-like mass, running parallel to the spinal column and attached firmly from apex to diaphragm in such a way that expansion is practically impossible. Forcheimer also makes the statement that "Schede's operation would be uncalled for if the adhesions could be removed in some other way."

All sorts of devices have been invented in order to increase the intrapleural pressure and so cause the lung to expand. These undoubtedly have their place in those cases where the adhesions are few in number and recent in formation, so that they may yield readily to an increased pressure from without and the natural pressure from within the lung itself during respiration. One of my medical colleagues insists that any radical operation looking to a release of the lung from its adhesions is absolutely wrong; because he claims that as they contract they pull the lung nearer to the rib surfaces and so aid expansion.

Surgeons, however, who have had the opportunity of examining these cases as they occur upon the operating table, will recognize the fact that the lung can no more get away from these adherent bands than Gulliver could rise from the cords of the Lilliputians.

Von Bergman emphasizes the statement that we have all been taught by the physiologists, that if the opening in the pleural cavity is smaller than the diameter of the main bronchus the lung will again take part in normal respiration. His explanation of this is that the air will enter the lung during inspiration through the main bronchus with greater ease than through the opening in the chest wall, so that the collapsed lung is obliged to distend during inspiration. But if we agree to this statement, it is impossible for us to do any work in the pleural cavity which involves a larger opening than the diameter of the main bronchus, without having a collapse of the lung.

Dennis also says that the pleural surface is insensitive, since it is changed into the wall of an abscess cavity.

It is evident, therefore, that if we are going to make a success of any method of operating that calls for a re-expansion of the collapsed lung, it is necessary for us to invent either some method of operating in a vacuum, such as Sauerbruch's box, or prove that there is some way of bringing about expansion in spite of large openings in the chest wall, and in spite of the

These were the difficulties that confronted me in the beginning of my work. One of the earliest facts, however, that impressed itself upon me was that the statement in regard to the insensitiveness of the pleura was incorrect. It is perfectly true that under complete anæsthesia we do not get a response to an irritation of the pleura; but this is not true, even when the pleura is markedly thickened and covered with plastic lymph, if the anæsthesia is incomplete.

The next question that we had to determine was that of the elasticity of the pleura. If the generally accepted statements were correct, that the pleura lost its elasticity in consequence of the thickening and the inflammatory deposits upon its surface, one would be obliged to adopt the methods of Fowler, Delorme, or Ransohoff, and in those cases where success did not result from these methods recourse would have to be had to the Estlander or Schede method.

We were able to demonstrate very early in our experimental work that these facts were incorrect.

Having demonstrated that these preceding statements were true—that is, that the pleura in these cases was not insensitive, and that it was still capable of expansion—the difficulty which presented itself was the physiological statement that with an opening larger than the diameter of the main bronchus, the atmospheric pressure from without alone would be sufficient to keep the lung in a state of collapse, and in that way our efforts to fill the abscess cavity by a proper expansion of the lung itself would be impossible.

We soon recognized that this was true in all of our fully narcotized patients, and it was by working on these facts on

the living subject that we were able to perfect the method of operating that we have now employed for a number of years.

The opening in the chest is made in the usual way, and should take in from one to three or four ribs, according to the size of the cavity and the difficulty of reaching the collapsed lung. In young children, one rib is usually sufficient; in adults, from three to four are necessary. The piece removed should be from $2\frac{1}{2}$ to 3 inches in length, and as a general rule the sixth, seventh, and eighth are selected. The pleura is incised, and the accumulated fluid is allowed to drain away gradually at first. In all of these cases ether is the anæsthetic of choice in my hands, for the reason that we can have the patient under complete anæsthesia until the ribs are removed, and the effects of the ether narcosis last longer than the other anæsthetics after stopping the administration. Before opening the pleura, the anæsthetic should be completely stopped, in order that if we get a sudden expansion of the lung by its breaking away from its retaining adhesions we may not get an overdose of the anæsthetic, and in order that during the remainder of the operation the patient may be gradually coming out from the effects of the anæsthetic. As soon as the fluid has drained away, the opening in the pleura is made sufficiently large to enable the operator to make a thorough exploration of the whole pleural cavity, and to accurately locate the position of the collapsed lung. If there are large masses of coagulated lymph filling the cavity or adhering to the pleura, they should be at once scraped away, using a curette if necessary. The finger is then swept upward, if the lung is in the apex, until its margin is recognized, and a separation of the adhesions is carried on in exactly the same way that we separate the adhesions in the peritoneum. If these adhesions are so firm that they will not yield readily to the sweep of the finger along the pleural surfaces, the lung should be raised and a curved periosteotome swept along the parietal surfaces until the adhesions are freed. During the progress of this manœuvre the sensitiveness of the pleura asserts itself, and the partially anæsthetized patient begins to cough with each

sweep of the finger over its surface. With each forced expiration, expansion in the lung is seen to take place, until when the adhesions are fully broken up the lung with its pleural covering will entirely fill the pleural cavity and even press outward through the operative wound. This is undoubtedly due to the healthy lung forcing a larger amount of air into the main bronchus than can escape through the partially closed glottis in the effort at coughing, so that the excess passes over into the bronchus of the collapsed side. In this way the healthy lung is used as an air pump to expand the collapsed one.

Some years after I had demonstrated this fact, Dr. A. H. Smith, of this city, told me that he had experimentally proven the same thing. He demonstrated it by taking two pairs of bellows to which he attached rubber tubes which were carried upward into a "Y," and this was in turn attached to a larger tube on which he placed a spring. If one pair of bellows was then emptied, air could be pumped from the other and escape without having any effect on the empty pair, so long as the lumen of the larger tube was of sufficient size to allow of the egress of the full amount of air. As soon, however, as the spring on the larger tube was allowed to compress it, so that the full bellows-full of air could not escape at each compression, the air immediately flowed back and expanded the collapsed pair of bellows.

If the lung, instead of being in the apex, is compressed against the side and attached to the diaphragm, I have found it advisable to loosen the diaphragmatic adhesions first. These are usually much heavier and more difficult to separate than those in the upper part of the cavity. Care must also be exercised to recognize the margin of the lung and the curve of the diaphragm, both of which are sometimes very difficult to do. As soon as the separation of the diaphragm is complete, the other adhesions, as a rule, can easily be broken up by the finger, care being taken, however, if the empyema is on the left side, when one reaches that part of the operation where the pleura lies over the pericardium. Here the operator feels each contraction of the heart, and can tell at once exactly how much

pressure he can use in separating this portion of the lung. As a matter of fact, I have never had any difficulty during this part of the operation. It does not seem to cause any disturbance of the heart, and does not offer any greater difficulties in the separation of the adhesions than any other part of the cavity.

As far as possible, the operator should try to keep in contact with the parietal pleura during the separation of the adhesions, to obviate the possibility of tearing the lung. Sometimes it is impossible to avoid tearing off the pleura over a circumscribed area, and I have not infrequently produced a pneumothorax during the operation. This, however, no longer causes me any anxiety, as the healing process soon closes the opening in the lung; and, as a matter of fact, I have been successful in closing several cases of pyopneumothorax and getting a complete cure by this method of operating.

One of the difficulties that caused me a great deal of worry in the beginning, was the fear of tearing into the lung and having a severe hæmorrhage. I have, however, never had any difficulty of this kind in any of my cases where it was not possible to control the hæmorrhage very readily. In case of opening a vessel in some portion of the lung that is not directly under the field of observation, the operator should at once have the anæsthetist put back his anæsthetic and bring the patient under complete narcosis. The lung will then again collapse and the bleeding will either stop from this alone, or it can be found and controlled either by means of the Paquelin cautery or any other measure that may seem advisable. We have found that it is an aid in these cases to wash out the pleural cavity, sometimes two or three times during the course of the separation of the adhesions, in order to get rid of the blood clot that results from the oozing from the denuded surfaces, and to get rid also of the coagulated lymph that is set free during the course of the manipulation. This is always done by having hot saline poured into the wound from a pitcher—never from a metal douche or an irrigating bottle. In this way there is no increase in hydrostatic pressure, and the fluid poured in is washed around by the expanding lung and flows

out again through the free opening at each expansion. As soon as the lung is fully expanded, a drainage tube is inserted, the skin wound closed around the tube, and a voluminous dressing applied.

We found in the course of our work that it is impossible in these cases to use a drainage tube of the old type. It almost invariably—by its rubbing against the pleura of the expanded lung—kept up a constant pleuritic cough, another illustration of the fact that the pleura is not insensitive in these cases. Dr. H. D. Furniss, formerly house surgeon of the New York Post-

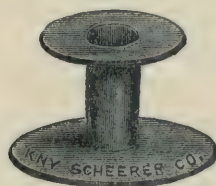


FIG. 1.—Drainage tube.

Graduate Hospital, while on the staff devised a tube to obviate this difficulty. This is simply a piece of rubber tubing with a flat piece of rubber on either end, made in different lengths to fit different thicknesses of chest wall. In appearance it is very similar to a spool. The smaller flange of this tube rests against the inner wall of the chest, while the outer and larger flange rests upon the skin and prevents the drainage tube from falling into the pleural cavity.

The after treatment of these cases is conducted in the same way that is usual in other cases of empyema. A spirometer is useful in keeping up the full expansion of the lung, and with children the small rubber toys made to blow up help materially with the subsequent pulmonary gymnastics.

I have now operated on 225 cases by this method. Only those cases where the history was complete have been included in these statistics. Of these, 97 were cured and 58 were improved. Of the 58 improved cases, 40 were referred to the dispensary for dressing, and the great majority of them were completely cured; 9 were sent to the summer home; 9 were transferred to the Health Department hospitals. One of these

died some time after being taken home; the particulars are not known. Seven cases have been operated upon a second time, and in these it is surprising to find how thoroughly the lung has remained in full expansion. In one, an adult, operated upon some years ago for a very extensive empyema, a second operation was necessary because he lost his drainage tube into his pleural cavity. In order to reach these tubes it was necessary to separate the adhesions on each side of the sinus where they had been lying, the pulmonary and the parietal pleuræ being in contact everywhere excepting at the point where the tubes had rested.

There have been 47 deaths, or 20 per cent. This, of course, includes the deaths from all causes and for all periods of time after operation. The causes of death were:

Nephritis, suppression of urine, and turpentine poisoning..	1
Nephritis alone.....	1
Tuberculosis	3
Pyæmia, 19 days.....	2
Enteritis and pneumonia.....	1
Attack of vomiting 3 weeks after operation.....	1
Pneumonia, both sides.....	2
Collapse on opening chest.....	1
Diphtheria	3
Volvulus	1
Empyæma and abscess of lung.....	8
Shock	8
Exhaustion, from 2 to 42 days.....	22

If we take into account the cases dying within one week of the operation, as due to the effects of the operation itself, we get 15 cases. The others in the above list, in all probability would have died under any method of operation.

The length of time the patients have remained in the hospital, has varied from 6 to 42 days, an average of 29 days.

In children under 18 months of age the mortality is very much higher than in older patients.

The shock following this operation is distinctly less than in the other operations for chronic empyæma. Within two or three days the patients are able to sit up, and they are usually out of bed within a week.

CYSTS OF THE OMENTUM.

BY RUFUS E. FORT, M.D.,

OF NASHVILLE, TENN.

A female child, two and a half years old, was presented February 21, 1906. She was fairly well nourished and gave history of no illness except two attacks of acute indigestion, each lasting several days. Abdominal enlargement was noticed eighteen months before by her mother. This had progressed until child now had an abdominal circumference of twenty-eight inches at the umbilicus. General health and nourishment had been very good, with no symptoms referable to the abdominal condition, except some dyspnoea upon exercise.

Examination revealed the following physical signs, great abdominal distention, abdominal veins prominent, complete dullness upon percussion over entire abdomen. Not a resonant note could be found anywhere. Fluctuation and a decided thrill wave could be elicited at any portion of the abdomen. Pulse 100°, temperature and urine normal.

The enormous abdominal distention led me to the conclusion that gradual relief of the hydrostatic pressure upon the splanchnic vessels offered the safer course. Consequently, on February 23, five pints of dark bloody fluid were removed by aspiration. In five days examination showed some decrease in the size of the abdomen from the time of the aspiration.

The abdomen was opened through a median incision, extending from above the umbilicus upward. There presented at once a dark glistening tumor, having the appearance of a distended gangrenous intestine, which, owing to its flaccid condition, was delivered through the incision without rupture. It was found to be a collection of fluid in the folds of the great omentum, extending from under the pylorus on the right along the greater curvature of stomach, to and including the folds of the gastro-splenic omentum. A chain ligature of catgut was applied from right to left, including the omentum and the gastro-splenic ligament. There were no adhesions, so the work was rapidly

accomplished. The abdomen was closed. Recovery was uncomplicated and the child left the hospital well in two weeks.

Closer observation of the specimen shows the absence of a distinct capsule, the fluid being between the folds of the omentum. There was an absence of fat in the omentum but the vascularity of the omental wall, as would be expected, was great. Closer inspection showed the stab of the aspirator five days before had not closed but continued to leak, this accounting for the decrease in the abdominal measurements, from day of aspiration to the day of operation. There was, however, no free fluid in the peritoneal cavity, the absorption having been quite in proportion to the leakage.

The fluid had a specific gravity of 1.007 and contained albumin and many degenerated blood cells.

In reviewing this subject we find it first described by Gairdeur¹ in 1851. Subsequently I have collected twenty-one cases. The case which I have reported, so far as my investigations have gone, will make the twenty-second case.

The three points which have impressed me most are: First, the impossibility of diagnosis without exploration; second, the condition is seen most often in children under ten years, 50 per cent. under ten—65 per cent. under twenty, which leads us to the belief that it is of congenital origin; and third, it occurs more frequently in females, 75 per cent.

Jacobi² states that perhaps all of these tumors are of lymphatic origin and result either from dilatation of the lymph vessels or from cystic degeneration of the lymph nodes. He submits this as Rockitansky's idea, however, and offers no further evidence. The histologic characteristics of their encapsulation and the contents of these cysts, however, are of such a variety, that it is hard to believe that a distinct etiologic factor can be arrived at. Lymph, chyle, serum, both with and without blood cells, have all been reported. Two dermoid cysts have also been reported, Waldy³ and Spencer Wells⁴ reporting such cases.

The presence of a distinct capsule within the folds of the great omentum has been observed, but in a majority of cases,

we find the tumor separating the folds of the great omentum with no other encapsulation. Again we find the tumor with a distinct capsule, not within, but attached to the omentum by thin ribbon-like bands. This leads Phillips⁵ to suggest that they find their origin in the ovary, subsequently becoming detached by twisting of the pedicle, and continuing life by attaching itself to the omentum. The same question presents itself to Jessett,⁶ but he admits his position is not tenable, by stating that the large vessels passing around the entire cyst came direct from the omental vessels.

Jacobi⁷ believes that it will always be a question whether the hyatid omental cyst originates in the liver or in the omentum.

Marsh and Monserrat⁸ report a case of a child, less than two years old, with a large cyst with a distinct capsule showing externally an endothelial covering and covered internally by a coat of fine connective tissue with numerous blood channels, the connective tissue coat being represented by a marked layer of fibrous tissue. There was great vascularity of the cyst wall, which he suggests as being evidence of the traumatic or inflammatory origin of the condition; but this case had been repeatedly aspirated, and I assume that trauma and local peritonitis from aspiration could have produced the same condition.

The case reported by Hearne⁹ furnishes the most convincing proof of the congenital origin of these neoplasms. This was a case of a boy, age eight, in which he obtained a distinct history of a fluctuating tumor at birth, which decreased in size for some time, after which distention became apparent. It was aspirated at the age of four but refilled and was removed four years later by Hearne.

Cotman¹⁰ reports a most interesting case of a young lady, age twenty-one, who received an injury by being thrown violently against the shaft of a cart, upon whom he operated three months later. The omentum was curled up under the posterior portion of the greater curvature of the stomach with a cyst connecting with a perforating wound of the posterior portion of its pyloric end.

This is the only case reported which has a distinct history of trauma, and the symptomatology in this case is also unlike the remaining cases. There were repeated attacks of collapse, vomiting, continued pain, and altogether a clinical picture much graver than we find in the other reports.

The youngest reported case is the one reported by Schramm,¹¹ a child one year old. This patient's abdomen measured thirty and one-half inches in circumference. A dark grumous fluid was within the folds of the great omentum.

A case reported by Young,¹² of London, in physical characteristics, is identical with the case which I have just reported.

Symptomatology.—It is rare that these tumors are discovered in earlier stages of their development. Pain is not usually an accompaniment, and when it is present it is not severe in character, and is usually attributable to digestive disturbances, though several observers have noticed that the radiation of pain was usually toward the liver. It has also been observed that during pain there are marked digestive symptoms. Anorexia, dyspepsia, vomiting, diarrhoea, alternating with constipation and even cachexia.

The costal type of respiration and severe dyspnoea have also been observed. Hahn states that the special symptoms of tumor of the omentum present an extraordinary analogy to those of movable kidney. I can see that this may be true in those cases in which we have a disturbing symptomatology, but in the case of my own, as well as in others, there was an absence of subjective symptoms sufficient to point to any diagnosis. It is evident, therefore, that omental tumors present no characteristic symptoms, and the clinical picture is that which accompanies all other forms of cystic abdominal growths.

This is emphasized by the fact that the omentum possesses no physiologic function other than a covering membrane. Therefore, it is most natural that small tumors will produce no symptomatology, and that symptoms will only be produced when the weight of the tumor produces dragging or when pressure symptoms occur.

Diagnosis.—No case has yet been reported in which the

diagnosis has been positively and accurately made. The condition has been diagnosed as ascites, lipoma, aortic aneurism, hydatid cyst of the liver, pancreatic cyst, cyst of the urachus, tubercular and encysted peritonitis.

Peau mentions three points as pathognomonic of omental tumor. First, superficial location, second, abnormal passive mobility with downward limitations, and third, absence of functional disturbance, to which Anganeur adds that respiration has little or no effect on the position of the tumor, and Witzel has noticed movement of the tumor with intestinal peristalsis.

I conceive that in the earlier stages of this condition, where there has been an absence of an inflammatory process, consequently an absence of adhesions to the adjacent viscera, that these points may be of diagnostic value, but the rare occasions on which we will see these tumors in this stage, I fear, give but little practical value to their suggestions. This is proven by the fact that Peau, as well as others, have failed to make the diagnosis.

Palpation.—Palpation reveals an elastic growth with fluctuation. The thrill wave is present and dulness is absolute over entire tumor on percussion. This shows its cystic nature and that it is anterior to the hollow viscera. Lipoma is the only solid tumor with which it may be confounded, fluctuation having been elicited in this condition.

Differential Diagnosis.—The superficial location may simulate neoplasm of the abdominal wall, lipoma, though lipoma is usually fixed. It occurs almost always in adolescence and there is an absence of pressure symptoms.

Pancreatic tumors are usually malignant, productive of constant pain, usually produce icterus, fatty stools, and rarely occur before middle life, and, as a rule, coils of the intestine yielding a tympanic note may be found over the tumor. Cyst of the urachus, though rarer than omental cyst, if seen early, its origin may be observed to be lower and its mobility is less marked and the same in all directions.

In cyst of the mesentery we usually have a coil of intes-

tine anterior. Ovarian cyst in their earlier stages may be differentiated by pelvic examination and by the physical signs, showing that the tumor springs from the lower zone of the abdomen.

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TUBERCULOSIS OF THE BLADDER.

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(Continued from page 283.)

PART II.

DIFFERENTIAL DIAGNOSIS.

The symptom complex, progressive increase of frequency and pain in micturition, pus and tubercle bacilli in the urine with occasional blood at the end of urination, occurring in a patient, in the absence of any other definite cause, is strongly suggestive of tuberculosis of the bladder. All of these symptoms, however, may be met with in the absence of any bladder lesions, in tuberculosis of the kidney or of the prostate. Hunner cites several instances of tuberculosis of the kidney which presented only bladder symptoms, whereas cystoscopic examination proved the bladder to be free. The only positive sign, is the appearance of the mucous membrane as seen by cystoscopic examination or through an artificial opening.

Bladder tuberculosis is to be distinguished from tuberculosis of the kidney, tuberculosis of the prostate, simple ulcer, various types of pyogenic ulcerations, pyogenic cystitis and new growths.

Over and over again *tuberculosis of the kidney* has been mistaken for disease of the bladder, for the reason that the kidney process very often in the early stages shows itself mainly or entirely through bladder symptoms—frequent or painful micturition, etc. This distress is induced reflexly from the kidney, or by irritation of the urine, and is not due to lesions of the bladder mucosa. A careful inquiry into the history will usually bring to light the fact that the patient has suffered at some time from pain, or other sensations referable to the affected kidney; and a careful palpation of the renal region will generally show physical signs, enlargement, rigidity of the

muscles and tenderness. Frequent and painful micturition, accompanied by blood at the end of the act is very strongly suggestive of bladder implication, but the only positive information is to be obtained by cystoscopic examination.

In *tuberculosis of the prostate* with extension to the posterior urethra, there is much local discomfort and great bladder tenesmus. In such a picture we have three considerations to help us; first, rectal examination may point to implication of the prostate, but does not exclude the bladder; secondly, the first specimen of urine voided may be comparatively free from pus, while the last is very cloudy; this, however, is suggestive of implication only of the prostate, without disease of the bladder.

Simple ulcer of the bladder is a well-known but an infrequent condition. When the lesion is situated near the trigone, many of the distressing local symptoms of bladder tuberculosis are produced. Here we must rely on the absence of tubercle bacilli from the urine, the absence of tuberculosis elsewhere in the body, and the difference in the cystoscopic picture. A simple ulcer as seen through the cystoscope is usually circular, the edges are fairly smooth and regular and are not undermined, the base shows a red and firm granulation tissue, and the surrounding mucosa presents no evidence of tubercles.

In *ulcerations* due to the various forms of cystitis, the appearance is very different from that of tuberculosis. The inflammation of the mucosa is very much more extensive; the ulceration is more superficial and occurs as small areas scattered here and there over the inflamed mucous membrane. There are no tubercle bacilli in the urine, and the other organs are free.

Stone has occasionally preceded the development of tuberculosis and has very frequently complicated it; in such instances it is of course impossible to arrive at a differentiation by means of the ordinary objective symptoms. As a rule a calculus does not produce the extremely distressing, frequent, and painful micturition that belongs to tuberculosis; the frequency is less at night, is alleviated by rest and exaggerated

by exercise. All doubtful cases should be examined through the cystoscope.

Acute pyogenic cystitis presents a symptom-complex similar to that of tuberculosis, but should never be mistaken for it; for the one is relieved in a short time, while the other persists. Chronic pyogenic cystitis never gives rise to symptoms of such an intense degree as does the tuberculous inflammation.

Papilloma occasions less bladder disturbance, causes less pus in the urine, and produces more profuse and more continuous bleeding.

Carcinoma is seen in older patients and is not attended by the same distressing symptoms until a later stage, when a diagnosis can be made from other signs.

MEANS OF DIAGNOSIS—*Cystoscopy*.—When it is considered how little can be done for such a tuberculosis, even after a diagnosis is made, and when it is realized that a slight trauma may prove a source of danger by allowing an infection to occur, or by furthering the extension of one already present, the advisability of the introduction of a cystoscope seems questionable. But, on the other hand, when the need of finding out the exact state of the kidneys, and of determining the presence and extent of disease in the bladder so as to more clearly settle the question of operation is fully appreciated, all objections are removed.

Cystoscopic examination, owing to the diminished capacity and the extreme irritability of the bladder, is often unsatisfactory and occasionally impossible, but a patient and a careful trial will in most instances be amply rewarded. The method which I employ is as follows: When possible the patient is given 1 gramme of cystogen every three hours for 12 hours before the examination and directed to drink an increased amount of water. When the bladder is very irritable, a hypodermic injection of $\frac{1}{4}$ gr. of morphin is administered half an hour before the introduction of the cystoscope. The genitalia are cleansed with warm water and soap and washed with a 1-1000 bichloride solution; the urethra is irrigated with 500 cc. of sterilized salt solution; the penis is then wrapped

with a sterile piece of gauze, the glans not being covered. One ounce of a 4 per cent. solution of cocaine is then injected into the urethra by means of a blunt-pointed syringe (the cocaine solution must not be sterilized, but the crystals are put in a sterile bottle and dissolved in sterile water); this is retained for 5 minutes, the meatus being grasped with two fingers. Such an amount of cocaine would seem to be large, but I have no hesitancy in injecting even more, provided there are no recent abrasions of the mucous membrane which have been made by the introduction of instruments. Next, a previously boiled silk catheter with a prostatic curve, lubricated with sterile glycerine, is introduced into the bladder, and the organ very carefully washed out by injecting and immediately allowing to flow out 20 to 30 cc. of sterilized water. These washings are repeated until the liquid returns clear. One hundred and fifty cc. of sterile water are then injected into the bladder, provided it will tolerate that quantity; if not, the viscus is filled to its capacity. If less than 100 cc. is all that can be retained, the examination is not satisfactory, and if less than 60 cc., nothing definite can be seen.

In obstinate cases which will not tolerate sufficient fluid, I first inject 1 oz. of a 4 per cent. cocaine solution and then fill the bladder with a 2 per cent. solution. In this way I have been able to inject sufficient fluid to give a fairly satisfactory inspection. Where there is any bleeding I use from $\frac{1}{2}$ to 1 oz., of a 1-2000 solution of adrenalin.

Tubercle Bacilli.—The method which I have lately employed for the detection of tuberculous organisms is as follows:

Procure if possible a catheterized specimen; if this is done with ordinary precaution, we can be reasonably sure of avoiding contamination with smegma bacilli. When the use of the catheter is not feasible, I thoroughly cleanse the gland with soap and water and then wash it with a 1-1000 bichloride solution. The patient is then directed to urinate and the first half of the urine is thrown away; the second half is caught in a sterile conical glass and put aside for four hours to settle; the supernatant fluid is poured off and the remainder centrifuged.

galized. In females, in order to avoid contamination by smegma bacilli, it is always necessary to use the catheter, for it is much harder to cleanse the urethral orifice thoroughly than in the male. Young and Churchman have found that by thoroughly irrigating the anterior urethra in males before urination smegma bacilli are entirely eliminated. After the urine has been thus prepared the sediment is taken out with a clean pipette and one drop put on each of 4 slides; these slides are then adjusted on an iron ring some distance above a Bunsen burner, care being taken to have them high enough to prevent too intense a heating, and are allowed to remain until the fluid has evaporated and they have become perfectly dry; they are then passed lightly through the flame, placed again on the ring, and the smears are well covered with carbolfuchsin solution. The flame then is passed backward and forward under them, so that they become hot enough to give off vapor, but not sufficiently so to boil; this heating is kept up for four minutes, fresh fuchsin is added from time to time, and the specimens are carefully watched to prevent evaporation; they are then removed, washed lightly in running water, and immersed in Gabbet's methylene blue, where they remain until all of the red color has disappeared. There is no danger of decolorizing the tubercle bacilli, if they have been well stained with the red. The usual instruction, of applying the Gabbet's solution for from one-half to one minute, I disregard entirely, and am governed only by the disappearance of the red color. The specimens are then washed again, the excess of water is removed with blotting paper and ordinary xylol poured on and allowed to remain for two or three minutes; after this immersion oil is quickly applied before the specimen has had time to dry.

In the examination I use a mechanical stage, and go over the whole field in four or five slides. If these precautions are carried out, tubercle bacilli will be found in every instance of bladder tuberculosis.

For directions, in case it becomes necessary to differentiate between smegma bacilli and tubercle bacilli, I refer the reader

to my former paper on renal tuberculosis. Several observers have stated that smegma bacilli are somewhat broader than tubercle bacilli, are arranged in smaller clumps, and scattered more evenly and more numerous throughout the field, whereas the others are more slender and are seen in crescent-shaped masses. In ammoniacal urine the tubercle bacilli take the stain with some difficulty and are more readily decolorized; in some instances they cannot be stained, but this is very exceptional.

Tuberculin.—The use of tuberculin is a moot question. Two cases have been reported in which it rendered a latent bladder tuberculosis active; another, in which it increased the progress of a renal tuberculosis. Morelle cites an instance in which an intractable tuberculous cystitis was lighted up, after an injection of tuberculin given to determine the presence or absence of disease in the lungs. Bäumlér records a case of tuberculosis of the kidney and bladder which were made very much worse by its use. Roux saw incontinence of urine, hemiplegia, and aphasia develop after two injections for a tuberculosis of the prostate.

Many experimental injections into animals have proved that the toxin has a baneful effect on the kidney epithelium. On the other hand, there are numerous eminently qualified and careful clinicians who assert that it has no injurious effect, and T. Warren Brown and Schröder have reported two cases in which its use seemed to be beneficial.

Wright and Douglas have proved that tuberculin T. R. in sufficiently large doses to produce a decided reaction is harmful. I think, therefore, that this work stands as evidence against its use for diagnostic purposes.

In consideration of these possibilities, and knowing that it is comparatively easy to make a diagnosis by other means, I do not think that tuberculin should ever be given.

Cryoscopy.—The determination of the freezing point and the molecular concentration is of no service in tuberculosis of the bladder. The same may be said of the administration of phloridzin, methylene blue and other drugs.

PROGNOSIS.

A few, but very few, cases of tuberculosis of the bladder heal; a minority run a chronic course, extending over a number of years; but in the majority the progress is more or less rapid and the downward course is marked by few interruptions. The symptoms tend to increase in severity and the terminal months are attended by an extreme suffering which is hardly equalled in any other disease. The process is prone to destroy the bladder and to spread to other organs. The average duration of life, after the disease has become established, is somewhere in the neighborhood of 35.05 months.

It is certain that the disease may heal either spontaneously, or as a result of surgical or hygienic treatment. Personally I have not seen such an instance, but the character of the observers places their statements beyond doubt. Haenens watched a tuberculous ulcer for 2 years, and noted its final healing; Stoeckel in a careful study with a cystoscope has seen both tubercles and tuberculous ulcers clear up; Cumston, Strauss, Motz, Hallé, and Battle have observed similar results. These records, together with a number of others, in which are noted the disappearance of bladder lesions after nephrectomy, prove beyond doubt that it can occur. In my collected series of 416 cases, there were 29 cases reported as cured; I have excluded as far as possible the doubtful ones, but I have been compelled to include some others about whose nature I was not thoroughly convinced.

But surgical and medical measures applied directly to the bladder (except the complete removal of the focus) have in the majority of instances no effect; indeed in not a few they are harmful; the disease, in spite of, or by the aid of, these interferences, tends progressively downward, and the patient finally succumbs to general tuberculosis, or is worn out by the frequent and painful micturition. Hygienic treatment—change of climate with proper care and appropriate food—offers by far the best chance for recovery.

So far as the bladder condition itself is concerned the

ulcer usually confines itself to the mucous coat, but occasionally it perforates the bladder wall. The disease process inclines very early to extend from the bladder to the prostate and vesicles, but only very exceptionally does it ascend to the kidneys. Formerly an ascension was thought to be very common, but now it is known to be extremely rare; in order that it may occur, there must be some underlying pathological condition, which allows the tuberculous urine to regurgitate along the ureter, and remain in prolonged contact with the mucosa of the pelvis. Lewin and Goldschmidt have concluded, from experiments on rabbits, that a certain regurgitation happens during contraction of the bladder when the viscus is about half filled. These experiments have not been confirmed by others, but even if such a regurgitation does sometimes take place, the urine quickly returns into the bladder.

The tendency of bladder tuberculosis to spread and form general miliary tuberculosis, cannot be definitely estimated, but does not seem to be great.

TREATMENT.

A study of those cases of tuberculosis of the bladder which I have seen, and a careful analysis of the reported instances, force me to the conclusion that, with the exception of hygienic treatment and the complete removal of the focus, there is very little to be done for this malady. Drugs have no good effect, and other direct surgical treatment seems to do little good and frequently much harm. Nevertheless, it may be as well to pass in review the various medical, hygienic and surgical measures that have been recommended.

Medical Treatment.—The agents which are recommended for internal use are guaiacol, iodoform, cod-liver oil, arsenic, ichthyol, and not a few others. There is very little evidence to prove that these have any effect on tuberculosis of the bladder, and personally I believe that they are all useless. Diuretics and urinary antiseptics, such as urotropin and salol, may mitigate secondary infections, but on tubercle bacilli they have no influence. The cases which have been reported as cured by medical treatment would probably have recovered without

it; the medicine, so far as the cure was concerned, was more co-incidental than causative.

Tuberculin.—This agent has been used in numerous instances, in most of them without benefit; two patients, however, the synopses of whose cases are given below, showed decided improvement: T. Warren Brown reports the case of a female of 16, who had undoubted tuberculosis of the bladder as evidenced by the presence of tubercle bacilli in the urine and tuberculous lesions in the bladder. After three months' use of Koch's T. R., there was decided alleviation of the symptoms, and the ulcers in the bladder had undergone retrograde changes. The second case, recorded by Schröder, was that of a female, aged 39, who suffered from great vesical distress, had tubercle bacilli in the urine, and characteristic ulcers in the bladder. Tuberculin T. R. was used for five months; the patient improved very much and gained in weight, but later she had a recurrence.

The very recent and extremely suggestive work of Wright and Douglas on the control of the administration of tuberculin T. R. by using the tuberculo-opsonic index may prove of great value, but as yet the method had not been sufficiently used to determine its clinical value, although the improvement which has been noted by Wright in some cases of tuberculosis of the bladder appears very promising.

Pardoe has used tuberculin in very minute doses, not sufficiently large to produce any reaction. He agrees with Wright and Douglas that the reactive doses are harmful. He has treated several cases of bladder tuberculosis with marked benefit. A few patients, he states, were practically cured.

Hygienic Treatment.—A suitable climate, plenty of good air and sunshine, combined with good food, go farther toward combating bladder tuberculosis than any other agents at our command. The same climates that are of use in pulmonary tuberculosis are equally serviceable in this form of the disease. I usually recommend patients with means to go to the Adirondacks for about two years; others, who are obliged to earn a livelihood, I send to Colorado, California or New Mexico.

The recent observations of Halsted on the beneficial effects of out-door life on joint and other forms of surgical tuberculosis are very encouraging and give us reason to hope that many cases of genito-urinary tuberculosis will be similarly benefited.

As much well selected food as the patient's digestion can stand should be given, eggs and beef forming the base. Milk, which is so valuable in kidney and bladder diseases and which forms a large part of the diet in pulmonary tuberculosis, should be taken in bladder tuberculosis more sparingly, for the imbibition of fluid necessitates more frequent urination and consequently more bladder irritation. In general, then, sufficient liquids to carry on the proper body metabolism should be allowed, but more than this may prove injurious.

Surgical Treatment.—Suprapubic opening of the bladder, combined with curetting, cauterization, or excision; complete removal of the bladder, perineal section; curetting and cauterization through the urethra in the female; cauterization through the urethra in the male; artificial vesico-vaginal fistulæ; irrigations and instillations; removal of the primary focus (nephrectomy, nephrotomy, castration, prostatectomy, and prostatomy); and resection of the nerves for relief of pain, are the measures which have been proposed to combat bladder tuberculosis.

Suprapubic Cystostomy.—The first suprapubic opening for tuberculosis of the bladder was done by Guyon in 1885; three years later Poncet after doing a cystotomy sutured the bladder wall to the abdominal wall in order to prevent healing. The technique of this operation is difficult, for the reason that the bladder by its contraction is drawn well down into the pelvis and can be only slightly distended. To partly overcome this hindrance and force the bladder toward the suprapubic region, Peterson devised a rubber bag which is placed in the rectum and distended. This apparatus is a valuable adjunct, but it should be used with care since two ruptures of the rectum have been recorded after its use.

The uses of the suprapubic opening are: First, to drain

the bladder and relieve the distressing symptoms; second, to allow of the use of measures against the disease process, excision, curetting, cauterization (by heat or chemicals), the application of remedies (such as iodoform) which are thought to be anti-tuberculous.

A cystostomy for the relief of symptoms is usually employed in the late stages when the patient is being worn and harassed by frequent and painful micturition; in such a state a suprapubic opening is most urgently demanded and is followed by immense relief, but that the opening and drainage have any distinctly beneficial effect on the disease is doubtful. A great many cases have been reported as improved, but it is probable that the beneficent influence was induced by the relief of symptoms rather than by the betterment of the actual disease.

Secondly, to attack the disease. When we study tuberculosis of the bladder by cystoscopic examination, or by observation after death, we find that, while gross lesions appear to be more or less circumscribed and superficial, careful inspection shows that in the large majority of cases the process is widely scattered over the mucous membrane and that the ulceration is often deep. Looking these facts squarely in the face, and realizing their full significance, the utility of trying to remove the diseased area would seem very questionable. What is really done in most cases, when this is attempted by curetting, is simply a partial scraping of the ulceration and a consequent wounding of the surrounding mucous membrane, with the possible scattering of the disease in the abrasions so made. This has been proved by a number of observations in which tuberculous granulations have sprung up extensively just after the operation. In order to study this subject more fully we will take it up in detail.

Excision of the Mucous Membrane.—I have records of this procedure 13 times; twice with complete removal of the whole mucous membrane of the bladder (Brohl and Bardenhauer) and three times with the resection of the portion of the bladder wall. Ten of the cases were followed by death

at varying intervals; one was not improved (Greiwer); two were improved (Greiwer, Matile). Brohl's and Bardenhauer's patients died some time afterwards. Young removed a section of the bladder in a case of tuberculosis of the seminal vesicles; the patient lived for a few months and died from general tuberculosis. Cushing excised a part of the bladder carrying a tuberculous ulcer; the patient developed cerebral complications, probably emboli, and died in a few days. Kelly in a number of instances has taken out a section of the bladder in conjunction with a nephrectomy; the immediate results in the majority were good; the ultimate reports I have not obtained. Delagenière excised all of the mucous membrane of the trigone and several areas from the bladder wall; the patient rapidly died of tuberculosis of the lungs. The results, therefore, of excision are not encouraging; in the twelve collected cases there were no cures and only two improvements.

The Paquelin Caутery.—Cauterization by heat was first practised by Guyon, since which time it has been frequently repeated; it has the advantage over curetting that it does not wound the surrounding mucous membrane, and that it does not scatter the disease; but it must be remembered that there is a very marked reaction from the burning, and that there is a large enough slough to be thrown off, which produces a lowered resistance and invites extension.

Cauterization by Chemicals.—Chloride of zinc, carbolic acid or nitrate of silver, may be of some utility; but when we consider that their action is at best superficial, that they do not penetrate deeply, and that they are followed by the production of necrotic tissue which entails sloughing and its consequences, we see that their use is not without certain disadvantages.

Iodoform Applications.—Iodoform possibly has some anti-tuberculosis effect, but has not fulfilled the promise which it gave at first. Guyon believes that it does not influence the growth of tubercle bacilli, but that it neutralizes their toxins. Nothing has been brought forward in the way of experiment to prove this point.

Results of Suprapubic Cystostomy.—In 119 suprapubic cystostomies there were 9 cases reported as cured, 48 as improved; 34 cases were reported as not improved, 27 as showing late deaths, and 1 operative death. The wounds were kept open for variable periods. Powers records one in which the bladder was drained for five years and the patient regained his former health. Bandler in a female kept the sinus open for three years, and the patient remained moderately well. In a number, a second operation was performed to close the fistula; there are eight recorded instances in which it remained open in spite of these efforts.

Desnos did a suprapubic cystostomy with complete excision of the diseased area; five weeks later the fistula showed tuberculous granulations and the bladder was nearly filled with them; the patient succumbed in 8 months. The same author has observed two other analogous cases. Matile reports a case in which the fistula closed and then broke down with granulations apparently tuberculous. Johnson did a suprapubic cystostomy and made a vesico-vaginal fistula; the suprapubic wound was allowed to heal and the vaginal wound kept open; the patient's health was completely restored. A Johns Hopkins Hospital patient, upon whom a suprapubic cystostomy was done, was wearing a drainage apparatus at the end of three years and reported very little local discomfort and good general health. Scherb in 12 suprapubic cystostomies with curetting had only one good result; some of the other patients improved, but only temporarily.

Loumeau reports 12 suprapubic cystostomies; 3 of the patients were cured, 8 were improved, and 1 died. These are included in the above statistics, but I am constrained to have some doubt about them for the reason that the percentage of cures is so high. In striking contrast with this are the results from Guyon's clinic as reported by Banzet; there were 13 suprapubic cystotomies; 7 of the patients died soon afterwards, 3 were not improved and had to submit to other operations, 5 obtained a passing benefit and 1 was very much improved; this last case is placed in my cured list, for it was

stated in a report made by Guyon that the patient was practically well.

Personal observation of the cases in my private practice and those which I have seen in hospitals, together with a study of the literature, convinces me that a suprapubic cystotomy should be done principally for the relief of symptoms, and rarely with the idea of removing the tuberculous area. It may be urged that in the above list the number of improved cases and the cured ones do not justify such an assertion. To this it can be answered that the cured instances of undoubted tuberculosis of the bladder are very few, fewer even than my statistics might indicate, for I have included some reports which to me were doubtful. In regard to the list of betterments, a following up of the patients will show that the amelioration is brought about usually by the immediate and great relief from the terribly distressing, painful, and frequent micturition; this riddance allows the patient to sleep and eat and become, therefore, generally better, but I submit that the disease in the large majority continues to progress.

Perineal Section.—Philip in 1803 did the first perineal section for the relief of painful cystitis. He was followed in 1806 by Blizzard and Guthrie. Thompson some time later improved the technique of the operation and brought it more into popular favor; several years afterwards it was further modified by Guyon. The first section of this kind for tuberculosis of the bladder was done in 1885 by Boursier.

In a collection of 26 perineal sections in my list 10 of the patients died, 1 was nearly cured, 5 were improved, 2 were unimproved, 2 were made worse; in 6 cases no results were given. In the 10 deaths, there were 2 patients who died from the effects of the operation—probably from peritonitis (Deltheil and Clado). While only two cases were reported to have been made worse, from the description of the patients after the operation, it is to be supposed that there was a larger number. Tédénat reports an instance in which miliary tuberculosis followed perineal section. Bryson had one case in which the wound filled with tuberculous granulations, and later ulcera-

tion into the rectum occurred. There were a number of others in which the wound became tuberculous and the sinus failed to close. Guyon reports 7 perineal sections; 6 of the patients receiving some benefit, but none being cured.

If there is an extensive tuberculosis of the prostate (prostatic abscess, etc.) perineal section is indicated, but for simple drainage or treatment of a tuberculous bladder, it is questionable if it ever should be done. The principal objection to it is that it necessitates a deep wound and it exposes various tissues—prostate, urethra, muscles—to infection by tubercle bacilli. Unless for a definite reason, perineal section should never be the operation of choice.

Entire Removal of the Bladder.—This has been carried out twice for tuberculosis. Both patients died within a short time. It is needless to say that an operation of such magnitude should never be performed when it is impossible to remove all of the diseased foci. This being the case in tuberculosis of the bladder, such a procedure is little less than criminal.

Removal of the Primary Focus.—This, in my opinion, is the operation which offers the best results from surgical interference. It is certainly the most rational procedure, for we have seen that bladder tuberculosis is practically never primary, that the organ withstands the presence of tubercle bacilli for a long time, that it becomes infected only after its resistance has been lowered, and that it tends to heal when freed from the infecting focus. Removal of the focus includes the following:

Nephrectomy.—In 19 nephrectomies, there were 5 deaths and 9 cures; the results in 5 were not given. There were many other patients who showed improvement of the bladder after removal of the kidney. These were collected in a former list of cases of renal tuberculosis and are not included in the present bladder series. It may be stated, I think, without question, that a mild infection of the bladder will heal after and that a more extensive one will be benefited by a nephrectomy.

Nephrotomy.—In cases of tuberculosis of the bladder in which nephrotomy was done, there were 2 deaths, 2 patients

were improved, and 1 was possibly cured (the kidney also healing). As there are only a few instances of tuberculosis of the kidney which have been cured by nephrotomy, the percentage of bladder recoveries must be very small.

Prostatectomy.—Up to the present time there have been so few tuberculous prostates removed from patients who were suffering also with bladder tuberculosis, that the general influence of such removal on the morbid process in the bladder is not known. It has not been considered right heretofore to excise a diseased prostate when the bladder also was involved; I am not thoroughly convinced that such conservatism is wise and intend to discuss the question more fully in a forthcoming paper.

Prostatotomy.—This is usually an operation of necessity brought about by the presence of an abscess. There are some patients in whom the bladder was probably implicated, who experienced great alleviation of the symptoms and improvement in health after prostatotomy, but I have not been able to find any case with sufficiently clear bladder records to enable me to form conclusions as to the ultimate influence of the procedure. It would seem reasonably certain that simple incision of a prostatic tuberculosis would be beneficial only when all of the diseased tissue had broken down into a softened mass and could be evacuated.

Removal of the Seminal Vesicles.—These organs have been excised for tuberculosis more than 40 times, but in these instances there was no report as to the bladder implication.

The results of the operation, therefore, in so far as the bladder was concerned, cannot be given.

Removal of the Testicles.—As I have not thoroughly reviewed the literature on tuberculosis of the epididymes, and have seen only a few cases in which a double castration was done in patients who were suffering also from bladder tuberculosis, I cannot state with exactness the effect which such a procedure has on the bladder; but from a general review I believe that removal of both testicles, when they contain the primary foci, has a beneficent effect on disease of the bladder.

Vesico-Vaginal Fistula.—Emmet in 1861 was the first to make a vesico-vaginal fistula for tuberculosis of the bladder. This operation has been practised extensively, but mainly upon patients who demanded relief from painful and frequent micturition. According to the reports many patients improved, but none, so far as I could find, were cured. Johnson records a complete restoration of health while the fistula remained open, but presumably the symptoms returned when it closed. Kelly and Hunner have had a few excellent results from it, but lately they have not practised it so much as formerly. The good effects of this operation are due mainly to the relief of the distressing bladder symptoms; further than this it has no influence on the disease.

Curetting Through the Female Urethra.—There were 17 cases recorded; 10 of the patients were unimproved, 5 were improved, and 2 were cured.

Out of the 10 cases recorded by Banzet, in 8 there was great improvement; the pain became much less, in some cases completely disappearing, and micturition was not so frequent; 2 patients were not benefited. Camero in 14 cases had 5 patients who were permanently, 5 temporarily improved; in 4 cases the results are not given.

Cauterization with chemicals has been practised both with and without curetting. In this connection Wittzack recommended lactic acid; it was used at first extensively, but is now less and less employed. Nitrate of silver is not well borne and seems to aggravate rather than benefit the disease, although Stoeckel, Noble, and others have seen good results from its use. Chloride of zinc is the most popular.

Cauterization Through the Male Urethra.—This is accomplished by means of a cauterizing cystoscope. One such case has been reported by Schmidt in which a tuberculous ulcer was treated in this way; some improvement followed, but the later history is not given.

Resection of the Sensory Nerves.—This operation was proposed for the relief of very painful and obstinate cystitis. It was first done in 1896 by Simpson; two years later Rochet

brought it into more general notice. The procedure consists in finding and dividing the sensory nerves of the bladder which pass off from the third and fourth sacral trunks. If the whole nerve (third or fourth sacral) is divided, enervation of the tissues in the perineum and possibly the penis will result. The technique of the operation is very difficult, because the nerves are small, obscure, and deeply placed.

Instillations.—Bichloride of mercury and iodoform have been extensively used; guaiacol, creosote, ichthyol, gemonol, and lactic acid have been occasionally employed.

Sublimate was first used in this manner by Jefsner in 1889; later it was recommended by Guyon, and has been used very widely by his students, in whose hands its use has met with considerable success; elsewhere, however, it has not received very enthusiastic praise. Casper has employed it quite extensively with benefit, and Kelly in the wards of the Johns Hopkins Hospital has had fairly good success from its use. The procedure is begun by injecting with a suitable syringe, once a week, 10 to 20 cc. of a 1 to 10,000 solution, and gradually increasing the strength up to 1 to 1,000. The quantity is slowly raised to 50 cc. Guyon instils from 15 to 20 drops of a 1 to 1,000 solution; Kelly injects 30 cc. of a 1 to 10,000 solution; Casper rarely employs a stronger than a 1 to 5,000 solution. The more powerful solutions produce considerable pain and tenesmus which often continues for one or two days.

In my collected series 18 patients were improved, 15 unimproved, 2 cured, and 3 made worse.

Guyon in 33 instillations reports 15 patients unimproved, 8 improved, 5 very greatly improved, and 2 or 4 cured (?). In Casper's hands, there were some cases which improved very decidedly, but none were cured. In one instance in a man of 37, the pain ceased, urination became less frequent and there was an increase in weight.

In consideration of the fact that the tuberculous process penetrates the mucosa, implicates the submucosa and occasionally the muscle, it seems that any agent such as sublimate which for any beneficial action is dependent merely upon its antiseptic

property—a property which is utilized only when it is brought into direct contact with tubercle bacilli—can have at best nothing more than a superficial effect. Moreover, it exerts a deleterious influence upon the bladder mucous membrane, lowering its resistance and favoring the spread of the disease. I think, therefore, that while sublimate does good in some well selected cases, in the majority its effects are baneful.

Iodoform, in 5 to 10 per cent. mixtures with olive oil, liquid vaseline or glycerine, has been very extensively employed; 10 to 15 cc. of one of these emulsions are injected from 1 to 3 times a week. This drug has a slightly anæsthetic effect, is very well borne, does not damage the mucosa, probably is slightly anti-tuberculous, and would seem to be the best agent for instillation. It has found much greater favor with the majority of surgeons than sublimate, and has the very great advantage of being in no way harmful.

In my series there were 23 patients improved, 7 not improved, 1 made worse and 1 cured.

Chaudeleux injected 10 per cent. iodoform in ether in doses of 3 cc. This produced great pain, intense burning and discomfort. The procedure is simply mentioned to be condemned. It is hard to imagine how a man with any surgical knowledge whatsoever could inject such a mixture into the bladder.

Guiacol has been used alone in oil, and in combination with iodoform, in strengths of from 1 per cent. to 3 per cent. It has a local anæsthetic effect and is well borne. There are a few cases reported as improved, but none as cured.

Gemenol in from 5 to 10 per cent. solutions in oil has been employed and recommended by Hain; 4 patients were improved and 2 were unimproved; none was cured; and none was made worse. The agent belongs to the turpentine series; it is decidedly antiseptic but is not irritating.

Lactic acid was first used by Wittzack, who injected 2 cc. of a 5 to 8 per cent. solution once a week. The reactions were very marked; the pain and frequency were much increased and the burning and discomfort exaggerated. Casper used this

remedy and later substituted lactate of cocaine for it. Both have now been abandoned.

Pyrogallic Acid.—Minet has had good results from the daily injections of 5 cc. of a 2 to 5 per cent, aqueous solution of this agent. Rovsing has also employed it with little benefit.

Formalin was recommended by Lamarque in the strength of 1 to 500; the amount of each injection is not given. Guyon employed this drug in 7 cases, but had no successes.

Creosote in weak solutions in oil was tried at the Necker Hospital in 3 cases of tuberculosis of the bladder, but had no effect.

Nitrate of Silver is now generally admitted to aggravate rather than benefit tuberculosis of the bladder.

In consideration of a few cures and a number of reported improvements following the use of instillations, it would appear that these procedures might merit a place in the treatment of bladder tuberculosis. Nevertheless, after personal observation of a certain number of patients and a careful study of the general literature, I am convinced that in the large majority of cases they do no good, whereas in some instances in which the more powerful drugs have been used—bichloride, nitrate of silver, and lactic acid—they have produced considerable damage. Personally, therefore, I neither use nor recommend them.

Irrigations with dilute solutions of silver, boric acid, bichloride, etc., have been given a very fair trial, more extensive than they deserve, and in the main have been found wanting. They do no good, and by distending the bladder they tend to aggravate the disease.

Rovsing has reported lately very satisfactory results from carbolic acid irrigations. He injects 100 cc. of a 0.5 per cent. watery solution and allows it to remain for 5 minutes, and then to flow out through a catheter; the process is repeated until the liquid returns clear. He treated 11 patients in this manner; 10 of them he reports as cured and 1 as greatly benefited. Certainly, the percentage of cures would seem to be remarkably high.

Summary.—When the primary focus is in the kidney, a nephrectomy should be done except in the very advanced cases and when the disease has become scattered. When it has originated in the epididymis, either an epididymectomy or castration is advisable, the choice of these procedures being governed by the extent of the disease. In those cases in which the infection has ascended to and implicated the prostate, the vesicles and the bladder, it is a question as to what is our best choice. In my opinion the operator should remove the diseased testicle or testicles along with the cord, and then wait for a while to see if this has any good effect on the prostate or vesicle; if improvement does not ensue, and the disease seems to be increasing, these organs ought to be excised, provided that the bladder is not too extensively affected, that the kidneys are free, and that there is no tuberculosis of the lungs or other organs. When the bladder, prostate, and vesicals have become infected secondarily to the kidney, a nephrectomy is to be recommended, and the remaining portion of the genito-urinary tract is to be left untouched at least for a while; later the enucleation of the prostate or vesicles may be considered. Complete removal of the seminal vesicles is an operation of magnitude and should be undertaken only after mature deliberation and then only by a skilful surgeon.

Irrigations of all kinds are useless and perhaps most of them are harmful. Instillations of all the stronger drugs are contraindicated. Iodoform in some cases may be of value.

The recent work of Wright and Douglas is full of promise, but it is too new to allow one to form an opinion as to its value.

In concluding this chapter on the treatment of bladder tuberculosis, I may be allowed to sum up the whole matter in one sentence:

Remove when possible the focus of bladder infection and send the patient to a suitable climate where he can live out of doors and where he will receive the proper quantities of well selected food. Surgical and medical treatment other than this has played a pitiful role.

(To be continued.)

DRAINAGE OF THE KNEE JOINT IN SEVERE INFECTIONS BY THE TRANSVERSE INCISION.*

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SEPTIC infection in the knee joint constitutes one of the most alarming conditions which the surgeon is called upon to meet.

The disastrous results both to limb and life render any procedure which can ameliorate its dire results and minimize the damage which inevitably follows worthy of serious consideration. Too often it has ended in amputation at or above the middle of the thigh, and not rarely in actual death from sepsis. In Flint's⁸ valuable study of infection of the knee joint, of 237 clean cases operated upon for various conditions 11 cases (4.6 per cent.) were infected and required subsequent drainage. Of these one came to amputation. Thirty out of 52 penetrating wounds of the joint were infected (60 per cent.), and of the 30 infected cases 4 died with or without previous amputation, 2 recovered after amputation and 2 after resection, 20 recovered with varying degree of disability, 4 of the 20 having complete ankylosis.

In his summary of 62 infections demanding operation, there were 7 deaths, 4 recoveries following amputation and 2 following resections; 49 recoveries with disability varying from slight limitation of motion to complete ankylosis.

While these statistics show the disastrous results of knee-joint infection, they also show a sufficient number of recoveries with good or reasonably good functional results from the simpler methods of drainage to illustrate one point which I

* Read before the New York Surgical Society, Dec. 12, 1906.

wish to make, *i.e.*, that the method to be described is applicable only to severe cases where the best results aimed at are to save life, avoid amputation and secure a useful limb without joint motion. It is second in severity to amputation only, and should be reserved for cases in which efforts at drainage and irrigation have failed to check the process, or in which the general sepsis is such a grave menace to life as to prohibit the trial of less radical procedures. Employed in such cases I believe that limbs may be saved that would otherwise be sacrificed, and that the general sepsis may be checked with less immediate risk and often with greater certainty than by thigh amputation during the height of the infection. The fresh wound area exposed to absorption of septic products is insignificant, compared to that of a thigh amputation performed in a condition where asepsis is practically unattainable, and instead of the great wound and freshly sawn bone, one has the untouched synovial membrane and articular surface to aid in protecting the general system from further invasion of the sepsis. The lesser shock is also an important advantage in many of these desperate cases.

While the transverse incision has been employed by many surgeons since C. H. Mayo's original report in the *ANNALS OF SURGERY*, January, 1895,¹ it has seemed to me that in many respects it has not received the attention it deserves. Important points in technique, difficulties which one meets in carrying a case to a successful outcome, the reasons for and against complete resection as a secondary procedure have either been ignored or briefly alluded to in the few case reports, personal and published, which I have been able to find.

Technique.—The technique employed in the cases which have come under my observation and in my own case is briefly as follows:

1. A transverse curved incision crossing the patellar ligament to the posterior border of the condyles and prolonged upward as a shallow U (Fig. 1).
2. Complete division of patellar ligament, anterior capsule, both crucial and both lateral ligaments, leaving the pos-

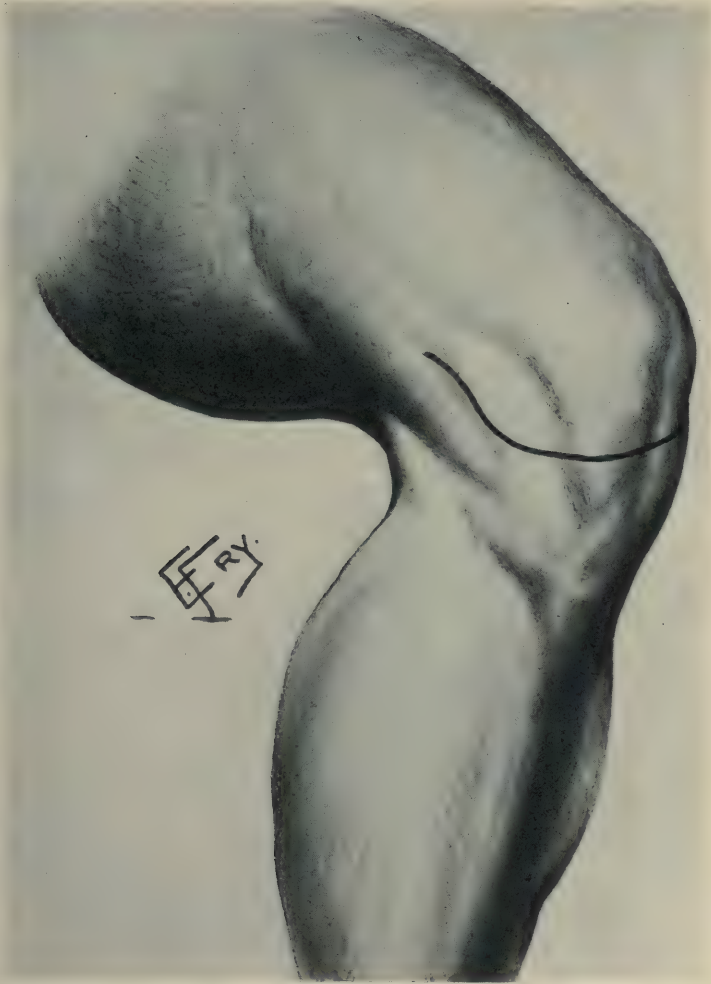


FIG. 1.—U-shaped incision crossing patellar ligament to posterior border of condyle on either side, and prolonged upward a short distance to allow the complete turning back of anterior flap upon the thigh.



FIG. 2.—The patellar ligament, anterior capsular ligament and both lateral ligaments have been divided. The bones are still held firmly in contact by the crucial ligaments. The lateral expansions of the quadriceps prevent the turning back of the patella and free opening of the bursa.

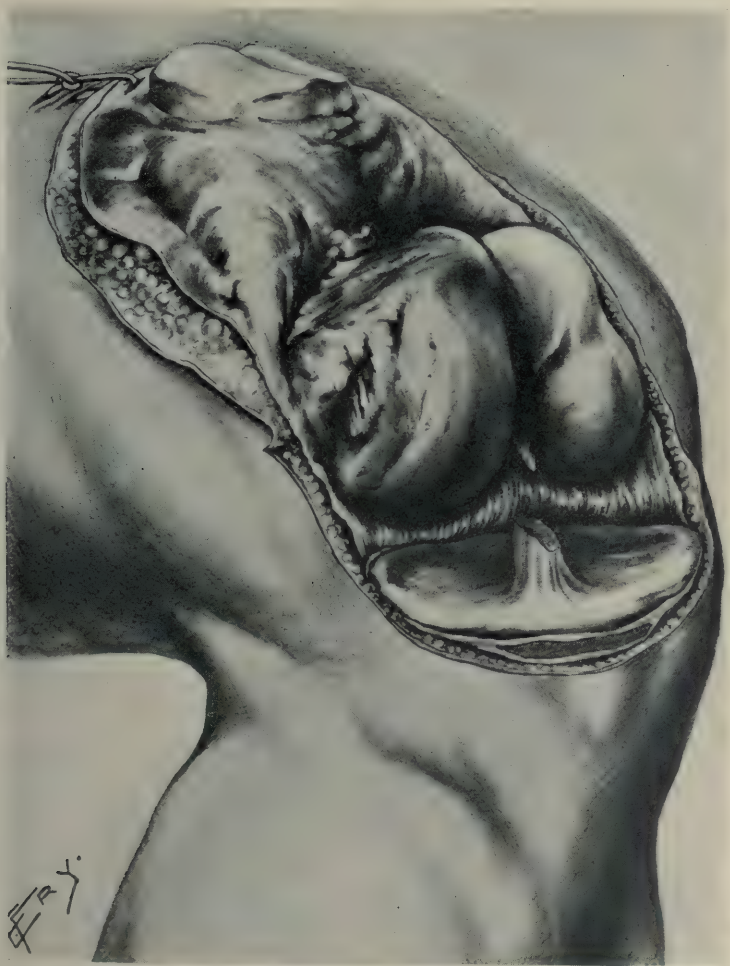


FIG. 3.—The crucial ligaments are divided, allowing the bones to drop apart. The lateral expansions of the quadriceps tendon are freely cut, the anterior flap everted and stitched to the thigh. The posterior recesses of the joint and the quadriceps bursa are now widely opened.

terior ligament alone intact, allowing separation of the bones and opening widely the posterior recesses of the joint. (See Fig. 3.)

3. Lateral cuts through wall of quadriceps bursa, muscle and aponeurosis, allowing the complete turning back of the anterior flap, including the patella and all tissues down to the joint, which is then fastened to the skin of the anterior aspect of the thigh with a suture of heavy silk, opening the great bursa widely to its apex (Fig. 3).

(Fig. 2 shows the incision before the division of the crucial ligaments and the lateral cuts. The bones are still firmly held together and the posterior recesses of the joint imperfectly drained. The patella and skin flap cannot be everted, and the upper part of the joint cavity and quadriceps bursa are insufficiently opened.)

4. Light packing of the entire joint with gauze moistened with a weak solution of bichloride or formalin and fixation of the limb in flexion (between 60 and 80 degrees) on a suitable splint.

5. Secondary resection of the joint after suppuration has ceased, the temperature is practically normal, and the joint and wound surfaces are covered with healthy granulations.

In cases severe enough to justify this method ankylosis is a foregone conclusion. Attempts to straighten the limb without resection are attended with great difficulty, owing to contracture of the hamstring muscles, and the tendency to posterior dislocation of the tibia. Contraction of the skin flap leaves a broad area across the anterior aspect of the joint, covered with hummocks of granulations, which heals slowly or demands subsequent skin grafting.

Ankylosis between articular surfaces not resected takes place slowly and uncertainly, and if imperfect with just enough motion to cause pain is far less desirable than firm union of sawn bone.

Resection seems, therefore, the preferable secondary procedure if the technique described is followed. The bony apposition is accurate and union firm; the skin flaps can be nearly

or quite approximated; and if done at the proper time, clean and prompt healing may be expected. The shortening should not exceed $1\frac{1}{4}$ to $1\frac{1}{2}$ inches, and does not add greatly to the disability. In children who have not attained their growth, however, the danger of excessive shortening from damage to the epiphysis is an important consideration.

From information kindly given me by Dr. R. F. Weir and from C. H. Mayo's original case report, the technique employed by W. J. and C. H. Mayo, as I understand it, differs radically in some important respects from that which I have above described.

The patella is divided transversely, the crucial ligaments are not cut and resection is not done as a secondary procedure. After the joint is clean, the attempt is made to suture the patella or its ligaments, the limb is straightened, and partial restoration of function is aimed at and obtained in some of the cases.

It would seem that this procedure should occupy a place between the simpler methods of drainage and the more radical method described, reserving the latter for cases in which secondary resection is the definite end in view. If the process can be safely checked without division of the crucial ligaments, and with preservation of even a limited range of motion, it is unquestionably the better method, and in certain cases this attempt might be made, leaving the division of the crucials to be done subsequently if needed.

There are cases of the more severe types, however, in which nothing short of the complete operation, opening widely every recess of the joint will save limb or life. In an unpublished case reported to me personally in which the crucial ligaments were not divided the process was not satisfactorily checked; the case recovered with complete ankylosis and posterior displacement of the tibia after prolonged suppuration during the course of which the crucial ligaments sloughed away.

The advantages of the operation over immediate resection are that it greatly lessens the danger of failure of union from

suppuration, septic osteomyelitis, or death from sepsis as a result of the operation. Even if amputation should become necessary later, the free joint drainage as a preliminary step should lessen the danger of that procedure.

After Treatment.—The after treatment is of great importance; cleanliness is difficult to maintain, dressings are exceedingly painful and the greatest patience, gentleness and care in their performance is necessary.

The limb should be fixed in flexion (60° to 80°) on a bent wire splint, molded plaster of Paris triangle or some suitable apparatus. The entire region of the joint and wound, and often the site of secondary abscesses in thigh or leg must be left accessible for dressings. Pressure on the popliteal vessels, with consequent œdema of the leg, as well as pressure sores on the heel or other bony points, must be carefully guarded against. The everted skin flap should be separated from the thigh by strips of gauze.

It usually requires from three to eight weeks for suppuration to cease and the joint and wound surfaces to become sufficiently clean to permit of straightening of the limb or secondary resection.

The history of the following case illustrates some of the points dwelt upon in the preceding remarks:

B. T., 21 years of age, a Greek peddler, was brought from Bellevue to the French Hospital on June 23, 1906, with a history of having received some injury to the right knee about May 15, 1906, which resulted in infection of the joint. Multiple drainage openings were made, and at the time of his admission to the French Hospital, thirty-nine days after the original injury, there was an advanced stage of suppurative arthritis with abscesses in the muscular planes of the thigh, and disorganization of the joint. The temperature ranged from 100.5 to 102.5 degrees, pulse 104 to 120.

Blood examination showed 17,400 leukocytes, 85.4 per cent. polynuclear cells. Blood culture was negative; cultures from pus in knee showed staphylococcus aureus in pure culture. The constitutional effects of chronic sepsis were marked, and it seemed

as though amputation would be necessary. It was determined however to first try the method of drainage by transverse opening of the joint, and operation was performed on June 28, 1906. A transverse curved incision was made crossing the patellar ligament, extending to the posterior part of the condyle on either side. From that point it was prolonged upward sufficiently to allow of eversion of the flap, which consisted of all the tissues down to the joint, including patella and anterior wall of the great bursa. The patellar ligament, the anterior capsule, both lateral ligaments and both crucial ligaments were divided, the posterior ligament alone being left intact. The eversion of the flap above referred to was then accomplished by making lateral cuts through the muscle and fascia, laying the quadriceps bursa widely open to its apex. The leg was flexed to an angle of about 60 degrees, the ends of the bones easily separating for an inch or more, and every recess of the joint was widely opened.

The suppurating tracts in the thigh were then freely opened and drained, and the limb put up in flexion on a triangular plaster splint. This had been constructed so as to avoid pressure on the popliteal vessels and interference with the circulation of the leg.

The temperature fell gradually, remaining below 100 after the twelfth day. The general condition improved, suppuration diminished and at the end of three weeks the entire wound surface was covered with healthy granulations.

Resection of the joint was done on July 19, 1906, twenty-one days after the first operation. Contraction of the flap and of the hamstring muscle made removal of $1\frac{1}{4}$ to $1\frac{1}{2}$ inches of bone necessary in order to approximate the skin edges, and secure good position of the limb. The sawn ends were fastened together with heavy silver wire. The patella was excised and the quadriceps and patellar tendons sutured together. Even with the removal of bone, retraction of the skin flap rendered perfect apposition impossible and narrow gaps between the few tension sutures inserted were left to heal by granulation. Healing was satisfactory and clean; bony union good and on September 20 the wires were removed, and the patient allowed to walk about with only a short splint. He remained about the wards and was quite content to act as a helper until November 1, when he was discharged able to walk easily without the assistance of a cane.

I am indebted to Dr. Weir for permission to mention two other unpublished cases which have come under his care.

The first was a man 25 years of age, admitted to Roosevelt Hospital on March 8, 1900. He had received a penetrating wound of a knee joint two days before admission. Infection had occurred and the joint was irrigated and drained through incisions on either side of the patella.

Suppuration continued, and on April 3 the joint was opened transversely, the crucial ligaments divided and the U-shaped flap turned upward and fastened by suture in that position. The limb was treated in flexion of 30 degrees on wire splints. On April 22, the patient coming then under the charge of Dr. Weir, extension was applied to the flap. The temperature which had not gone to normal however continued to rise, reaching 105.4 on May 6, 106.2 on May 7. On May 8 thigh amputation was performed. Good recovery followed and the patient left the hospital improved on July 4, 1900.

The second case was a boy of 6 years, admitted to Roosevelt Hospital on October 16, 1905, under the charge of Dr. Brewer, with a penetrating wound of the knee joint. Lateral incisions, irrigation and tube drainage were first tried, but symptoms of sepsis continued and six days later Dr. Brewer laid the joint freely open by a transverse incision, dividing the crucial ligaments and turning the patella upward. The case came under the care of Dr. Weir soon after, and on December 4, forty-three days after the transverse opening of the joint, resection was performed. Suppuration had ceased and the joint and wound surfaces were covered with healthy granulations. The temperature had been practically normal for some time. Resection was decided upon only after the great difficulty in overcoming the posterior displacement of the tibia and dealing with the contracted skin flap had been demonstrated. The patella was excised, a thin slice of bone removed from tibia and femur and the bones wired. Recovery was satisfactory and uneventful, bony union was firm and healing without suppuration. The patient was about ready for discharge when he developed measles in the ward and was transferred on January 21, 1906.

A third unpublished case was one in which the typical operation was performed by Dr. Brewer on a man suffering with

infected wound of the knee joint, on August 30, 1901, the crucial ligaments being divided, the flap sutured back, and the limb treated in flexion. Lateral incisions, irrigation and drainage done August 19 had failed to control sepsis.

The case was progressing favorably but not yet in a condition to warrant straightening of the limb, when he was removed from the hospital by his friends, against advice, on September 16, 1901, eighteen days after the operation.

Dr. Blake has given me notes of an unpublished case of non-traumatic suppurative arthritis in which transverse opening of the joint and turning up a U-shaped flap was done on a child 11 months of age, March 26, 1901. The crucial ligaments were not divided. The process rapidly subsided and the limb was straightened without resection nine days later. Shortly afterward the child developed scarlet fever, and was transferred. Healing was not complete at the time of transfer but suppuration had ceased and the local condition was progressing favorably.

Dr. Lilienthal has had three unpublished cases, which recovered with ankylosis, all in children. The joint was opened transversely and the crucial ligaments were divided; the limb treated in flexion, but instead of everting and fastening back the flap, it was split, through its centre to the apex of the bursa by a separate longitudinal incision after removing the patella. The limb was straightened without resection in all of the cases.

I have been unable to find a sufficient number of recorded cases to draw statistical conclusions of any value.

C. H. MAYO published his original case in 1895 and four subsequent cases in 1897,³ all recovered, two of the five having partial joint motion, stated to be about one-quarter of the normal range. In three only was it possible to re-suture the divided patella.

GERSTER reported two cases in 1895,⁴ mentioning the ugly scar resulting in one case, a girl of 8 years of age, straightened without resection 38 days after the primary operation. He commended the method as described by Mayo, but gave few details as to technique.

BREWER, in 1901,⁵ published a case in which good recovery followed the complete operation, with division of the crucial ligaments and fastening back of the flap. Resection was done 6 weeks after the primary operation. The case was one of marked severity, with profound sepsis and joint destruction.

WHITEHEAD⁶ reported a case in which infection followed an operation

which he had performed for excision of a semilunar cartilage, in which incisions, irrigation and drainage failed to control sepsis, and the joint was opened by the transverse method 15 days after the primary operation. Fifteen days later the limb was straightened and half the patella excised; subsequent Thiersch grafting was necessary to complete the healing. He considered the method original.

MAITLAND published a case in 1905,³ in which straightening without resection was done 13 days after the primary operation, resulting in recovery with ankylosis.

Of these cases, none are mentioned as having recovered any joint motion, except the two in Mayo's series.

W. J. MAYO, in 1901,⁴ wrote regarding the method, reporting recovery with 60 per cent. of the normal range of motion in some of the cases.

Résumé.—The operation should not be employed in mild or early cases, in which there is hope of recovery with some preservation of joint function, drainage and irrigation through multiple incisions being preferable.

A distinction should be drawn between cases in which the crucial ligaments are preserved and straightening the limb without resection, resuturing the patella or its ligament and preserving some degree of function is the end in view; and the severer cases where avoidance of amputation or death from sepsis are the sole considerations.

In the latter class of cases the complete operation is of great value, and should as a rule be followed by resection as a secondary procedure, except in children.

With the enormous raw surface exposed, dressings are exceedingly painful and cleanliness difficult to maintain. Pressure on the popliteal vessels with œdema of the leg, and pressure sores in the protracted cases must be carefully guarded against. Flexion of at least 45 per cent. on a suitable splint is essential. Satisfactory straightening of the limb without resection is often difficult and sometimes impossible on account of shortening of the hamstring muscles and contraction of the skin flap.

The secondary operation should not be performed until suppuration has ceased, surfaces are cleanly granulating and temperature is practically normal, a period of from 3 to 8 weeks being usually required.

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DIFFUSE CAVERNOUS ANGEIOMA OF THE UPPER EXTREMITY.*

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MAMIE McC., 12 years of age, applied to the Out-Patient Department of the Episcopal Hospital on October 16, 1906. She complained of disability of the right arm. On drawing up the patient's sleeve a cystic swelling was seen on the extensor surface of the forearm, just above the wrist. This was thought at first to be a tuberculous cyst, but when the whole upper extremity and thorax were exposed, the following condition was found: The front of the thorax on the right side is the seat of a nævoid formation composed of dilated capillaries or venules, giving the whole right pectoral region a distinctly bluish tinge. The discoloration is abruptly limited at about the mid-sternal line, and below by a line passing transversely through the tip of the ensiform process. The area affected is not raised above the surrounding healthy skin. Posteriorly the nævoid condition is not so marked; but below the angle of the right scapula a mass, about the size of a walnut, can be palpated. It feels like a lipoma. Just over the middle of the right clavicle is an angeiomatous mass, somewhat larger than a split pea, dark blue, protruding, and quite hard. Another similar phlebolith may be felt in the anterior axillary fold. In the right supraspinous fossa, at a point corresponding to the free margin of the trapezius muscle, is a somewhat larger bluish mass, which protrudes distinctly from the surface of the skin in this region, is compressible, and is evidently composed of cavernous tissue. An area of bluish discoloration, not raised above the surrounding skin, may be seen below the point of the shoulder, over the deltoid muscle.

The skin of the arm, forearm, and hand presents no abnormalities in structure, but the whole upper extremity is slightly livid, and there is œdema of the fingers and hand. On the exten-

* Read before the Philadelphia Academy of Surgery, December 3, 1906.

ser surface of the forearm, as already noted, there is a cystic, compressible swelling, not circumscribed, about the size of an egg. The flexor surface of the forearm in its upper half is also somewhat enlarged, and is indistinctly cystic. Elevation of the hand above the head causes an almost total disappearance of these swellings in the forearm, while they quickly reappear when the hand is lowered. By compressing the arm below the shoulder the hand and forearm quickly become alarmingly distended, the cystic swelling becomes bluish and very tense, and pain produced.

The circumference of the forearm above the wrist, when the hand is down, is 14 cm., but is only 11.5 cm. when the hand is elevated above the head. The circumference of the forearm below the elbow is 20.5 cm. when the hand is down, 18 cm. when it is raised. The circumference of the arm above the elbow is 19.5 cm. when the hand is down, only 17.5 cm. when it is raised. The measurements of the corresponding parts of the left upper extremity are: Above the wrist, 13 cm.; below the elbow, 19 cm.; above the elbow, 20 cm.

The length of the right upper extremity from the acromion to the tip of the styloid process of the ulna, the elbow being extended, is 41 cm.; that of the left is 43 cm.

The superficial veins of the affected forearm are not visible, even when the hand has been hanging down for some time.

The heart appears to be normal both in location and action. No abnormality in the other thoracic structures has been detected. The axillary, brachial, radial and ulnar arteries pulsate with fair regularity in their normal situations. The radial pulse, synchronous in both arms, varies from 90 to 100 per minute when the angiomatous arm is raised; and is about 120 per minute when it is dependent.

The cystic swelling above the wrist may be partly lipomatous in character, as it does not entirely disappear when the hand is elevated, some palpable irregularities persisting in the subcutaneous tissues. It is impossible to detect the extensor tendons by palpation.

Skiagraphs were made of the clavicular and cervical regions, and of the forearm. The former was entirely negative; the latter possibly shows some atrophy of the bones of the forearm.

Although the condition in this patient is congenital, it is only within the last few months that she has been disabled. Her



FIG. 1.—Showing increase in swelling when hand is down.



FIG. 2.—Showing decrease in swelling when hand is elevated.

family and her previous personal histories are negative. Her arm was always weak, and it was known that there was something wrong with it, but no particular attention was paid to it. She attended school regularly, and until the close of the session last summer was able to write and figure with her right hand. Of late the fingers and even the hand have become numb; the grasp is so feeble as to be practically absent,* and though she has resumed her school this autumn, she is no longer able to hold a pencil. There is present almost constantly a dull aching pain, which is considerably relieved by firm bandaging. A flannel bandage is applied with the hand elevated well above the head, and the arm is carried in a sling. General health good.

The following classification of angeiomata, taken from Mauclaire and de Bovis, considerably simplifies their description:

External	Superficial	<ul style="list-style-type: none"> Skin and external mucous membrane. Subcutaneous and submucous tissues.
	Deep	<ul style="list-style-type: none"> Intermuscular tissues. Muscles. Orbit and antrum of Highmore. Periosteum and bones. Subsynovial tissues. Glands.
Internal	<ul style="list-style-type: none"> Subserous: meninges, peritoneum, etc. Visceral: liver, spleen, etc. 	

These tumors are further classified as circumscribed and diffuse. The angeiomatous condition in the present patient appears therefore to be chiefly of the diffuse subcutaneous cavernous variety; although, as is not unfrequently the case, the neoplasm is really of mixed character, being cutaneous in small areas, as in the supraspinous fossa; and in the pectoral region is of the telangiectatic cutaneous variety, while in the forearm the growth undoubtedly involves the intermuscular planes, and has probably destroyed most of the muscular tissue.

* At present (February) the grasp is noticeably stronger.

Duplay and Cazin remark that subcutaneous angeiomata closely resemble cold abscesses in appearance, and it will be remembered that in the present case the swelling on the dorsum of the forearm was at first sight thought to be of tuberculous origin. The best clinical description of the cavernous angioma that I have been able to find is that given by Weinlechner, in Gerhardt's system.

Angeiomata of the extremities are rather unusual, and those of the diffuse cavernous type appear to be quite rare. Of all forms of angioma, including the ordinary mother's mark, the usual location is the head, and the least usual the limbs, as may be seen from the following table:

Head and neck.....	57 per cent. (Kramer), 79 per cent. (Gessler).
Trunk.....	28 per cent. (Kramer), 11 per cent. (Gessler).
Extremities.....	12.5 per cent. (Kramer), 9 per cent. (Gessler).

The question of treatment in these cases is as unsatisfactory as their pathology is obscure. Excision is scarcely possible in the diffuse form, though in cases of circumscribed cavernous angeiomata, whether cutaneous or subcutaneous, it is sometimes feasible, and is usually followed by permanent cure. Amputation at the shoulder joint, the most radical form of treatment available in the present case, might prove a remedy more serious than the disease itself; and in view of the implication of the pectoral and scapular regions might be followed by increase of the angeiomatic condition in the parts that were not removed. The injection of boiling water or other fluids, is a method neither invariably successful, nor entirely safe. Boiling water is much less dangerous than caustic or coagulating fluids, and in the hands of Dr. Wyeth, the originator of the method, has not, I believe, been attended by untoward effects. Other surgeons, however, without his experience, have been less fortunate. Payr has reported eight or nine cases of angioma treated successfully by the introduction of magnesium darts in the growth. The little darts, or tacks, as they have been called, are soon absorbed, but they induce the formation of compact connective tissue with throm-

bosis and obliteration of the blood spaces. Heide has quite recently treated a patient afflicted with a diffuse cavernous subcutaneous angioma of the lower extremity by means of electrolysis, and has obtained results which he considered satisfactory. He used a current of from 30 to 40 milliampères, for 3 or 4 minutes at each sitting. He began in the gluteal region, and gradually worked down to the foot; but the foot itself was not benefitted by the treatment, as the angiomatous swelling could no longer be made to disappear when the foot was elevated. Another result of the obliteration of the cavernous spaces and of the connective-tissue formation was that during the last sittings the hæmorrhage became considerably diminished in amount.

A brief abstract of all the similar cases it has been possible to find in a somewhat extensive search of the literature is appended.

(1) **ABBE** reported the case of a young man with an angiomatous condition apparently more cutaneous than subcutaneous, involving the whole right upper extremity. The skin was very thin, and the slightest scratch was liable to cause profuse hæmorrhage.

(2) **AUDRY**.—A female, aged 20 years, whose left upper extremity had always been larger than her right, had been troubled with its more rapid growth since the age of 8 or 9 years. The left hand and forearm to lower third of arm were very œdematous, spongy and compressible to touch. Ulcers formed in fingers, and arm was amputated through upper third of humerus, to hinder further infection. Dissection showed that the skin was thickened and elephantiasis-like in character. Beneath skin was a diffuse cavernous angioma, extending to bones, eroding them and destroying muscles and smaller nerves. The arteries were normal. The left scapular region was also affected, but it was more lipomatous in character than the forearm. The skin was nowhere nævoid throughout the upper extremity.

(3) **COLEY** recorded the case of a girl of nineteen years, whose fingers and the extensor surface of whose left forearm above the wrist were the seat of an angioma cavernosum, apparently diffuse and subcutaneous, although this is not stated. The swelling of the forearm was the size of an egg. Over the left scapula was a lipogenous angioma, the size of a cocoanut. All these swellings were adherent to the skin. The hand and forearm were bluish in color. The scapular growth was excised, and found to be an extremely vascular lipoma. An attempt was made to excise the growths from the fingers, but the operation was abandoned on account of hæmorrhage. Good illustrations accompany the report.

(4) CRUVEILHIER.—Female, 75 years, paralytic, demented, blind, no history. Left hemiplegia. The left upper extremity was flexed, rigid, and covered with varicose cutaneous and subcutaneous tumors. Autopsy showed that the subcutaneous tissues and muscles were the seat of a diffuse cavernous angioma; the skin was invaded in some parts, and in these regions bluish masses of varicose veins protruded. Several phleboliths were present.

(5) HEIDE.—Boy of 12 years, presented a diffuse angioma of the left lower extremity, involving buttock, back of thigh, popliteal space, fibular surface of leg, and dorsum of the foot. The skin was bluish, and prominent in places (cutaneous), although the main growth was subcutaneous and muscular. The circumference of the limb when dependent was 3 to 4 cm. greater than when elevated above level of trunk. Muscular power was very weak. A small piece of tumor was excised for examination; after cutting through the subcutaneous tissues, the deep fascia was seen, dark blue in color; on excising it the underlying tissue bulged out hernia-like, and looked like a mass of extremely thin walled veins, blackish blue in color. No trace of muscular tissue was visible microscopically, but under the microscope were observed a few atrophic muscle fibres, their place being taken by fatty and connective tissue. The cavernous spaces were lined with endothelium. The treatment adopted has already been described.

(6) LAMORIER.—Man, aged 70 years, the whole right upper extremity being affected, including the pectoral and scapular regions. The skin was bluish black, the angioma was diffuse, and on elevation of the hand the swelling rapidly disappeared from the hand, forearm and arm, and a larger swelling appeared in the pectoral and scapular regions. The condition was congenital, not painful; and autopsy showed all the muscles converted into a splenoid or placenta-like tissue.

(7) LICHTENSTEIN.—Man of 36 years, with diffuse subcutaneous cavernous angioma of right hand and forearm. At birth a small nodule was present on finger, and this was operated on in childhood. The angioma gradually extended up the forearm. The hand was cedematous and the forearm was the seat of a distinct swelling. The skin was not discolored except at scar of old operation. A few phleboliths were palpable. Superficial veins were not noticeable. The pulsation in the arteries was normal. There was no pulsation in the tumors. The patient was directed to wear an elastic bandage.

(8) LICHTENSTEIN.—A boy aged 7 years. At birth the left upper thoracic region and the left arm were somewhat blue; soon a lump the size of a small pea was noticed on the nipple, and another on the knuckle of the fourth finger. Four weeks before examination these lumps reached the size of large peas, and developed the characteristics of cavernous angiomas. The left upper extremity was shorter than the right by 3.5 cm. The superficial veins were not prominent, but there was present a diffuse cavernous angioma of the hand, forearm and arm; the axilla was full, no axillary folds being present. The pectoral region was bluish, and one small mass was palpable. Above the clavicle there

was a bluish line of veins. The skin of arm and forearm was distended when the hand was down, but became flaccid when it was elevated. The skin was involved, the angeiomatous condition having started apparently as subcutaneous in character, and later involving the cutaneous tissues. The arteries were normal, but the pulse was 80 when the arm was dependent, and only 64 when it was raised. No treatment is mentioned.

(9) RICHET.—A boy of 11 years, with a diffuse cavernous angioma of the subcutaneous variety on the lower two-thirds of the flexor surface of the forearm, involving also, by extension under the annular ligament at the wrist, part of the thenar eminence, in which latter situation the growth was rather of the cutaneous variety. The flexor tendons could not be palpated. The tumor was painful on pressure, and pressure caused it almost to disappear. Elevation of the hand rendered the color of the overlying skin nearly normal, and allowing the arm to hang down made it a deep violet blue, and on the thenar eminence a few varicose veins then became visible. The swelling of the forearm had neither pulsation nor bruit. This condition had lasted only 20 months. Treatment by injections of perchloride of iron was instituted, and when the patient was seen one year later, the swelling on the forearm was firm in consistency, little nodules being palpable wherever injections had been made. The tumor could no longer be made to disappear by pressure, and in the upper part of the forearm there was still evidence of the persistence of the cavernous condition. The skin had become even whiter than on the sound arm.

(10) ROKITANSKY.—Male adult, subcutaneous diffuse cavernous angioma, involving whole right upper extremity, and extending past axilla on to thorax. In certain regions soft bluish masses, feeling like lung tissue, projected from the surface of the limb.

(11) SCHUH.—Young man, subcutaneous diffuse cavernous angioma of anterior aspect of foot, extending up to knee. The growth had extended through everything down to the bone. Skin was scarcely at all affected, but was livid when limb was dependent. Many phleboliths. If the patient stood up the limb grew to an enormous thickness, and became blue and tense; but no varicose veins were visible. All the tissues between skin and bone seemed to have been destroyed by the tumor. It had not increased in the last 12 years, and with an elastic stocking patient was able to walk and even swim.

(12) SCHUH.—Young man, without known cause, suddenly developed growth on hand which rapidly extended up to middle of forearm. The skin was nævoid in places, and very thin. Elevation of limb caused skin to lie in loose folds, and outlines of bones could be easily felt. Phleboliths were palpable. No enlarged superficial veins could be detected. Amputation was refused, and the patient died a year later of phthisis.

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FRACTURE OF THE CORACOID PROCESS OF THE SCAPULA CAUSED BY MUSCULAR ACTION.*

WITH REPORT OF CASE.

BY ORLANDO H. PETTY, M.D.

OF PHILADELPHIA.

The following is my record of the case:

A man, 57 years of age, a trolley car conductor by occupation, while trying to forcibly put a drunken man off of his car, experienced a sudden and severe pain in his right shoulder, which practically rendered his right arm useless. He is sure that he neither fell, nor that his shoulder was struck in any manner. At the onset of the sudden and severe pain he was steadying himself by holding to the hand rod on the rear platform of the car with his left hand, the passenger being on the same level as the conductor, and was pulling with all his strength through his right arm trying to expel the disorderly passenger. During the several hours following the accident that he remained at work, he experienced severe pain in the right shoulder and an inability to use his right arm in ringing up fares or signalling the motorman.

The patient is a well developed, powerfully muscled man. When he presented himself to me, October 15, 1906, he was unable to raise his right arm from his side. He could elevate his shoulder but could not shrug it forward, although he could, with little discomfort, throw his shoulder backward, after it had been pushed forward.

The function of his forearm and hand was unimpaired. Examination revealed nothing wrong in the shoulder joint, clavicle, or acromion process, but severe pain was induced when pressure was applied over the coracoid process, and bony crepitus was elicited in this area.

* Read before the Philadelphia Academy of Surgery, December 3, 1906.

A fracture of the coracoid process being evident, the right arm was dressed in the Velpeau position, and later in the evening Dr. Fussell saw the case with me and confirmed the diagnosis. As the patient experienced great inconvenience from the Velpeau position, the dressing was changed, binding the right arm to his side, and leaving his forearm free.

Two or three days later, Dr. Pancoast of the University of Pennsylvania Hospital, took a skiagraph of the injured shoulder, and it revealed a fracture at the middle portion of the coracoid process, with a tipping downward and inward of the distal portion of the process. Dr. Pancoast said there had been many patients referred to him with a clinical diagnosis of uncomplicated fractured coracoid, but that this was the first case to be confirmed by the X-ray findings.

Result.—About the middle of the sixth week, crepitus having disappeared and the fracture apparently firmly united, the shoulder was treated by light massage and passive motion. He returned to work at the end of the seventh week. He is still unable to raise his right arm high above his head.

Fracture of the coracoid process of the scapula is not common, and an uncomplicated fracture of this process is a rare condition, while of its fracture by muscular force I could find but three cases mentioned. One of these was evidently discovered in the cadaver during dissection, another observed by Hulme, and the third a brief reference to a case of Stimson. These reports will be fully referred to later in this paper.

It is interesting to note the opinions of the earlier authors upon this fracture.

MALGAIGNE says: "This fracture is excessively rare, and does not occur except in company with other fractures and enormous contusion of the soft parts, so the case is generally of the gravest nature."

In S. D. GROSS's *System of Surgery*, 1864, we find the following comment: "The coracoid process is sometimes broken in consequence of a severe fall or blow, generally a short distance from its tip, the fracture being usually accompanied with great contusion of the soft parts."

ASHHURST, in Erichsen's "Science and Anatomy of Surgery in 1869," says: "The coracoid process is seldom broken, there not being more than ten or twelve unequivocal cases of this accident on record. It cannot

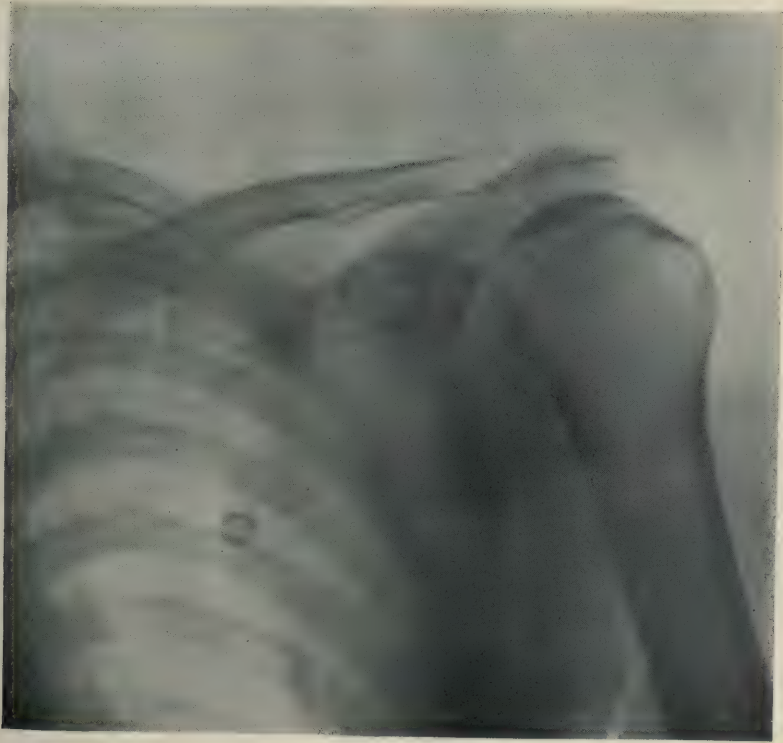


FIG. 1.—Fracture of coracoid process of scapula. Tip tilted inward.

happen except by direct violence." And even in a work as late as Scudder's "Treatment of Fractures," second edition, the coracoid process of the scapula is not mentioned as ever being the seat of a fracture.

Prof. EDWARD BENNETT of Trinity College, Dublin, in 1873, in reporting a case of epiphyseal separation of the coracoid process in a child of 6 years of age, caused by a crushing force, concluded with the following: "This specimen is of particular interest in as far as it completes the series of coracoid fractures in our collection, which contains already several specimens of the fracture associated with the dislocation of the humerus, a specimen of fracture from muscular action and fractures from direct injury in the adult."

J. Wellington Byers, of North Carolina, reviewed the fractures of the coracoid process up to 1885, and collected a score and a half of authentic cases of coracoid fracture but found none caused by muscular action. The following are his remarks on the etiology of the condition: "To class these injuries according to the manner of causation, it will be found that nearly half of them result from falls upon the shoulder, the others resulting from direct blows."

Byers either discredited or overlooked a case of fracture of the coracoid process by muscular action, reported in the *Lancet* in November, 1873, and thus described by HULME:

"T. H., æt. 57, miner. Three weeks previously he was on a bank in the act of passing through a wire fence when he slipped and in falling his left arm caught in one of the wires. He instantly felt a severe pain in the fingers, followed by loss of power in the arm and inability to raise the arm from the side. On examination it was found that the coracoid process of the left scapula was fractured and drawn downward."

R. CLEMENT LUCAS in *Guys Hospital Reports*, 1890, gives five methods of fracture of the coracoid process of the scapula.

- (1) Direct violence.
- (2) By dislocation of the humerus.
- (3) By extreme flexion of the shoulder joint, when the coracoid process is thrown into forcible contact with the under surface of the clavicle.
- (4) By downward crushing of the clavicle upon it.
- (5) By sudden muscular action.

Mr. ARBUTHNOT LANE in 1887 first called attention to the extreme flexion of the shoulder joint as a probable cause of fracture of the coracoid and cited as instances two cases quoted by HULKE in Holme's System of Surgery. They are thus described :

"Two cases of fracture of the coracoid process have come under my notice. In both the fracture was caused by a fall forward from a slight height, with the arms stretched forward. There was mobility of the tip of the process with crepitus and pain, but not displacement."

The comments of LUCAS are: "If this account be correct, Mr. Lane's explanation would appear to be the only possible one."

If the opinion of Mr. Lucas explains the two cases observed by Hulke, I think the theory of Lane, that extreme flexion may be the cause of the fracture, applies equally as forcibly to the case I have just quoted, which Hulme attributes to muscular action, for Hulme says that in falling the patient caught his left hand in one of the wires of the fence; this it seems to me would cause extreme flexion of the shoulder. The specimen referred to by Bennett, as being caused by muscular action, is in the museum of Trinity College, Dublin. There being no record of an examination at the time of accident and no history of the case, its etiology can hardly be considered unequivocal.

Stimson, in his work on fractures and dislocations, speaks of the fracture of the coracoid process of the scapula in this manner :

"This may be caused by muscular action or by direct or indirect violence. In the former the causative effort is sometimes comparatively slight, wringing of wet clothes in one case, but more often is a powerful effort made with the arm.

In reviewing the literature I have carefully read all the reports and reviews of the cases that I could find and found no case caused by muscular action, that had a full history of the accident and physical examination confirmed by skiagraph.

REPORT OF OPERATIONS

PERFORMED AT THE PUBLIC CLINICS FOR STUDENTS AT THE GERMAN HOSPITAL
OF PHILADELPHIA, DURING THE SESSION OF 1905 TO 1906.*

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TWENTY-SIX clinics were held at which there were 215 patients operated upon, with a total of 244 operations. It was found necessary to perform 52 operations on 23 patients at the same sitting. The mortality was 9 cases, or 4.2 per cent.

APPENDIX.—There were 64 cases of *appendicitis* operated upon, of which 39 were acute. Of the patients with acute *appendicitis* there were 29 males and 10 females. The appendix was found acutely diseased and removed at the same time in 4 patients operated upon for other conditions in which it was involved; of these patients 1 was a male and 3 females. In these 64 cases there was 1 death, that of an acute case in a male. The average duration of the attack for which the acute cases were operated upon, estimating from the onset of the attack up to the time of operation, was, in the 23 cases without abscess, 4 3-10 days, and in the 16 cases with abscess, 8 days. Seven of the 23 non-abscess cases were operated upon in their first attack, 9 of the 16 abscess cases had had no previous attacks.

The incision varied according to the pre-operative findings. Of these acute cases, in 12 the McBurney or gridiron incision was made; in 19 the incision was made either through or at the outer border of the right rectus, and of these, in 2 cases it was necessary to make a counter-incision in the right flank for extra drainage, and in 2 others, a small suprapubic incision for tubal drainage of the pelvis. The 8 remaining

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cases required extraperitoneal incisions, of which 3 were assisted by suprapubic counter-incisions, and 1 by a counter flank-incision. In 2 cases the pelvic exudate was drained by a tube emerging from the incision in the right rectus muscle.

In 7 cases there was free pus in the pelvis at the time of operation, in 10 there was an abscess near the cæcum, and in 9 the intestines were covered with lymph or pus exudate.

The appendix was subcæcal in 16 cases, to the outer side of the cæcum in 6, in one of which the organ ran up toward the liver, to the inner side in 3, and in 5 cases to the brim of the pelvis or into the pelvis. In 4 cases the pathological condition was so severe as not to warrant searching for the organ, or removing it even when seen. (In the remaining 6 cases, the position of the appendix was not stated.) The organ was necrotic or gangrenous in 9 cases, perforated in 4, kinked in 2, and the remainder were either adherent, congested, swollen, or covered with inflammatory exudate. When possible the appendix was wholly amputated flush with the cæcum, the resulting gap being closed by two semicircular silk sutures which intertwined at each pole of the organ, and in some few cases in which stump-amputation was performed, the invagination was maintained by a silk purse-string suture. The badly diseased appendices were ligated near their bases with catgut and the stump-surface cauterized with liquified carbolic acid, no invagination being performed.

Drainage was required in 15 of the 39 acute cases, and consisted of gauze in 6 cases, glass drainage tube with gauze in 8, and glass tube alone in 1. In the remaining 19 cases, the wounds were closed with tier sutures of chromicized catgut. The majority of the leukocyte counts maintained a direct ratio with the severity of the case. In many abscess cases in which the urine was examined shortly after admission and previous to operation, there was found a marked toxic nephritis which subsided within a day or two after operation. This deleterious action of the pus upon the economy in general and the kidneys in particular, not to mention the peritoneum, we consider a strong argument against postponing operative measures.

A young woman, whose first attack was two weeks under way on the day of admission, exhibited merely slight abdominal distention and slight rigidity of both recti muscles, but tenderness over the entire lower portion of the abdomen.

On incising extraperitoneally, a large amount of pus mixed with serum was evacuated, and 3 large abscesses were located and drained: one deep in the pelvis, another in the median line, and the third at the lower margin of the liver. As the appendix was bound in the abscess wall, it was not removed.

A man, whose second attack began two days before admission, revealed, on examination, general distention and tympany of the abdomen and board-like rigidity of both recti muscles. There was marked tenderness all over the right side of the abdomen, but especially over McBurney's point. The appendix was bound by plastic exudate to the cæcum, was 9 cm. long, thickened, swollen and congested, and the seat of two perforations. In places it was gangrenous. It was necessary to make a counter-incision in the right flank to permit of additional drainage.

The death occurred in a man whose case was very similar to that just cited, except that he was admitted four days after the beginning of his second attack. Examination revealed a leaky skin and evidences of general septic infection. The abdomen showed general distention and tympany, marked rigidity of both recti but greater on the right side, and general tenderness over the entire abdomen, most marked over the right iliac fossa.

Incision opened up a large retro-cæcal abscess in the vicinity of which the intestines were bound together in a plastic exudate, and elsewhere an extensive purulent peritonitis was present. The appendix was 7 cm. in length, retro-cæcal, gangrenous in its lower third, and perforated. So, too, as in the preceding case, a counter-incision was made in the right flank to obtain free drainage. The patient lingered five days after operation. Post mortem revealed an acute fibro-purulent peritonitis, focal gangrene of the cæcum and distal 15 cm. of the ileum, with parenchymatous degeneration of the liver and kidneys. These last two cases are almost identical in every respect, with the exception that one, the fatal one, was two days further advanced in his attack than the other, but *he died*, while the other recovered. This is another forceful and convincing illustration of the oft-repeated cry that *delay is fatal*. And it shows actually

the damage done to the organs by retention of highly toxic pus, which was spoken of above when estimating its effect on the kidney by clinical examination of the urine.

In 25 cases of *chronic appendicitis*, 10 were in males and 15 in females, with no deaths. The appendix was found chronically diseased and removed in 8 patients at the same time the condition for which the operation was performed was relieved; of these, 1 was a male and 7 were females. The time elapsing since the last attack varied from seven days to two years. In one case, that of a physician, the disease had existed for 12 years, until continual pain and soreness over the appendix when walking and after eating, which had existed since the last attack, a year previously, led him to seek relief. This same complaint was given by 8 of the 25 patients, bringing them to operation which almost invariably revealed adherent appendices. In 7 cases there was marked constipation, in 4 of which the appendices were bound down by adhesions. One patient, a female, suffered for a year with symptoms that simulated cholelithiasis, complaining of almost continual pain in the epigastrium, at times radiating to the right shoulder, frequent biliary vomiting after eating, and two distinct attacks of jaundice. Operation revealed a slender cord of omentum, 10 cm. long, between the otherwise normal gall-bladder and the chronically diseased appendix. The appendix of another woman contained 2 ascarides of the variety *oxyuris vermicularis* (thread worm). In a man the appendix was found anomalously placed on the ascending colon, 10 cm. above the cæcum. The other appendices were found to be thickened, kinked, congested, constricted or adherent. The lumina, usually patulous, at times were partially obliterated, or contained faecal concretions.

The McBurney incision was made in 16 cases and in the remaining 9 the incision was carried through the right rectus muscle. The appendix was wholly extirpated by the method mentioned above in 12 cases: the stump was invaginated into the cæcum by means of a silk purse-string suture in 12 cases, and in the remaining case the organ was simply amputated,

and the stump cauterized owing to its difficult retrocæcal position. The abdominal layers were approximated with tier suture of chromicized catgut in all cases except one.

Carcinoma of the Appendix.—This was present in the case of a female, aged 23, whose appendiceal history had extended over a period of five years, in which there occurred three attacks. The appendix was kinked and curled about the cæcum, curved on itself, its lumen obliterated, and its proximal part congested and swollen. Microscopical examination revealed carcinoma.

THE STOMACH—Pyloric Stenosis.—There were 7 cases of pyloric stenosis, 5 benign and 2 malignant. The benign cases were all due to chronic gastric ulcer, and all recovered from the posterior gastrojejunostomy. There were 4 males, ages 15, 20, 25 and 53, and 1 female, age 57. All complained of chronic dyspepsia.

In addition to the thickening, induration, and cicatrization of the pyloruses, the stomachs were all markedly dilated. Five years previously the oldest male had undergone a pyloroplasty elsewhere; after a year's relief, aggravated symptoms returned. In the female, the gastric mucosa presented a markedly hæmorrhagic "weeping" appearance, and the second and third parts of the duodenum were congested. Note was made that one of these patients on discharge two weeks after operation, could eat solid food without discomfort, and had gained two pounds already during that time.

The 2 carcinomata were in males, ages 50 and 55. In both the fulminating dyspepsia symptoms—6 weeks' duration in the elder with the loss of 35 pounds, and 1 year in the younger with the loss of 30 pounds in the latter 4 months—were strictly in contrast to the chronicity of the benign cases. Posterior gastrojejunostomy relieved the elder of symptoms. The death occurred in the younger emaciated man, who in addition to the stenosis showed perigastric adhesions, secondary carcinoma of the head of the pancreas, and a distended gall-bladder. Pylorectomy, drainage of the gall-bladder, and posterior gastrojejunostomy were performed.

Cardiac Stenosis.—There was one case of cardiac stenosis in the person of a female, aged 43, who suffered ten months from symptoms due to gradual thickening of the cardia. Operation revealed a large, diffuse mass at the cardia, extending down over the greater curvature, and infiltrating the wall sufficiently to prohibit gastrostomy. Jejunostomy, however, gave relief.

Acute Gastric Ulcer.—This occurred in a woman aged 37 years, who six months previously had been treated in the medical wards, when at one time she vomited 2,000 cc. of bright red blood; she apparently recovered and was discharged cured. Three days before admission to the surgical ward she had a recurrence of hæmorrhage, vomiting 1,500 cc. of bright blood. On the day of admission she vomited 2,000 cc. bright blood, and two hours after admission 1,500 cc. of dark blood. The patient was extremely anæmic, suffered from air-hunger, thirst and had a rapid pulse. She was treated medically with the hope that her condition would improve and warrant operative interference later; as there was no evidence of improvement and the patient was becoming weaker, gradually declining, it was thought under the circumstances best to do a posterior gastroenterostomy. The patient did not survive long. The mucosa showed multiple ulcers and a hæmorrhagic or "weeping" state.

LIVER AND GALL PASSAGES.—There were 8 cases of *cholelithiasis*, all females, in 4 of whom the gall-bladder was removed. Three had had enteric fever; in 1 this disease occurred four months previous to operation; chills in 1.

Jaundice occurred in 3 cases, biliary colic in all, biliary vomiting in 4, and nausea without vomiting in another.

Adhesions existed between the gall-bladder and transverse colon (1 case); liver margin, transverse colon and pylorus (1 case); omentum adherent to gall-bladder and liver (1 case); between omentum, transverse colon and gall-bladder (1 case); no adhesions 4 cases.

Calculi, from 2 to 500 were removed from the gall-bladders in all the cases, and from the cystic duct in 3; from the common duct in one case 4, and in another, 1.

Of the excised gall-bladders, 2 were greatly thickened, 1 was extensively diseased, and the fourth was the seat of

empyema. The four remaining gall-bladders were drained by rubber tube, from 20 to 300 cc. of bile of varying consistency being present. A rubber tube drained each of the 2 common ducts from which the gall-bladder and calculi had been removed. Strips of gauze and rubber dam were used in 7 cases.

In a case in which the gall-bladder was ulcerated, 200 cc. of bile-stained pus were evacuated from an abscess below the gall-bladder. The omentum was stitched across the wound in the middle, thus separating the upper wound from the gall-bladder below.

A chronically inflamed appendix was removed from one case.

Biliary Fistula.—This was present in a male, aged 23, a sufferer from enteric fever five years previously, from whose gall-bladder 200 calculi had been removed elsewhere 18 months previously, this operation being followed by a biliary fistula, to close which an unsuccessful attempt was made 4 weeks after discharge. The fistula was obliterated by invaginating the edges of the gall-bladder; drainage, 1 piece of gauze.

Cholecystitis.—Six operations for cholecystitis were performed on 3 males and 3 females, one of the latter dying 7 weeks afterwards from a pronounced myocarditis. Two patients had had enteric fever. All had been jaundiced, all had cramps or pain in the right hypochondriac region, and one had chills. Adhesions were present in one between the gall-bladder, liver and duodenum, and in another between the gall-bladder and pylorus. In no case were calculi found, and all the ducts were patulous. Drainage in each case consisted of a rubber tube sutured in the gall-bladder, beneath which was placed a gauze strip, isolated by rubber dam.

A chronically inflamed appendix was removed from one case.

Pericholecystitis.—A female aged 40 had been relieved of 25 biliary calculi elsewhere, 10 years previously, and a year later similar attacks of biliary colic recurred. A month before admission the previous drainage site opened up, discharged three calculi, pus, bile later, and closed again. The attacks ceased, but discomfort persisted. Operation revealed extensive adhesions between the abdominal wall, omentum, gall-bladder and duo-

denum, but no calculi. The adhesions were separated and gauze drainage instituted.

Chronic Interstitial Pancreatitis.—This occurred in a man aged 55, a sufferer from indigestion with occasional severe vomiting for 21 years. Six years previously he had sudden epigastric pain and since then slight epigastric soreness had persisted, and increased a year before admission, since which time he has experienced progressive loss of strength and flesh, reducing from 200 to 166 pounds in the year's time. On admission he was emaciated and anæmic, with a firm mass in the epigastrium. Operation, consisting in gall-bladder drainage by a rubber tube aided by gauze in rubber dam adjoining the cholecystotomy, revealed a hard nodular pancreas, moderate hepatic cirrhosis, gall-bladder distended with bile but no calculi. Before operation the fæces exhibited free fat and bile pigment, but no undigested muscle fibres.

HERNIA.—Inguinal.—There were 8 operations, 6 males and 2 females. Of these herniæ, 2 were bilateral, 3 right and 3 left, and of the right two were irreducible, 1 being strangulated. Half these patients had worn trusses. Primary union followed the 10 Bassini operations.

In one patient, a woman aged 23, the right inguinal hernia was congenital, and perineorrhaphy was performed at the same time.

Umbilical.—This woman, aged 42, the mother of 7 children, had had the hernia 10 years in addition to a left inguinal hernia. At operation, the sac of the former was adherent, and contained omentum but no gut. The recti were overlapped.

Incisional.—These 2 herniæ, both in women, followed appendiceal abscess operations that required free drainage. One was of 6 and the other of 30 months' duration.

Fæcal Fistula.—There were two cases of fæcal fistula. One developed in a student 5 days after the repair of an incisional hernia elsewhere, which in turn 3 months previously had followed an operation for acute appendicitis 3 years ago. Operation revealed a fistula in the cæcum 2 x 3 cm., and this was sutured with silk, over which was sutured an epiploic appendage.

The other patient, a male, was also operated on elsewhere 9 months previously for appendiceal abscess, and developed 9

days later, intestinal obstruction, requiring re-operation. Four days after this second operation, a fæcal fistula developed at the incision of the first operation, in which a glass tube had been used. The second incision had been sewn up, and was already healed. Operation revealed a fistula in the cæcum 1 cm. from the ileocæcal valve. The opening was closed with silk, reinforced by an epiploic appendage. The congested, swollen and adherent appendix was removed and the stump retained in invagination by a silk purse-string suture.

URINARY ORGANS.—*Wandering Kidney*.—There were 5 cases, 1 in a male, 4 in females, all on the right side. One patient had suffered for 2 years since being thrown from a wagon, striking on her right side. This kidney, movable to the third degree, was sutured by a modified Edebohl's method.

The second case occurred in a single lady aged 43 who, 5 months previously, had experienced pain and sensation of discomfort in the right side after having lifted her invalid mother. Three months later the patient had an attack of acute appendicitis. At the operation the wandering kidney was anchored by a modified Edebohl's method, and the chronically inflamed appendix removed.

Another patient had complained for 3 years of pain below the right costal margin. The third degree kidney was hammocked with gauze.

Associated with pyonephrosis was a freely movable kidney in a female aged 36, that had existed 18 months. To the ordinary symptom of dull aching pain in the right side were added, a month before operation, frequent, painful and scalding urination. Examination revealed a movable tumor in the right loin space, excoriation of the external urethral orifice, and retroflexion of the uterus. The Israel incision revealed an enlarged, grayish, lustreless kidney, the pelvis and parenchyma of which were the seats of multiple abscesses. The kidney, with 10 cm. of the ureter, was extirpated.

The fifth patient had been operated on at different places for various abdominal conditions, 11 times during the previous 14 years. One of these operations, 9 years before admission, consisted in anchoring the right kidney with silver wire. The patient had an attack of Ditell's crisis 7 and another 4 months previous to operation which revealed a small cyst at the lower pole of the

wandering kidney. The cyst was evacuated, and the kidney ham-mocked in gauze.

Ureteral Calculus.—Two cases of ureteral calculi, both of whom were females who had suffered frequently from severe attacks of renal colic for 10 years. In each case the right kidney was involved and removed. Operation revealed in one a right wandering kidney, of which the pelvis was diseased and contained a calculus. In the other patient there was a small calculus situate one inch below the pelvis, and immediately beyond it the ureter for a distance of about one inch was the seat of a fibrous stricture; microscopic examination revealed chronic pyelitis with early malignant proliferation. Both patients recovered.

Vesical Calculus.—This man, aged 56, during the past 11 years had had numerous attacks of renal colic in the left lumbar region, radiating to the groin and genitals. He had passed a number of calculi, and at one time, 3. The last attack occurred three weeks previous to operation, the patient feeling the calculus passing to the bladder. During urination the stream would stop suddenly. The calculus was removed by suprapubic lithotomy, and the bladder drained by a rubber tube. The pre-operative cystitis from self-catheterization subsided, and the urine was normal on discharge 60 days after operation.

Dorsal Neuritis.—This patient, a woman aged 30, had been operated on elsewhere 2 years previously for right wandering kidney. Since the operation the patient had suffered from gripping, dragging pain in the right lumbar region in any position she assumed. The pain radiated down over the right buttock. The diagnosis of chronic neuritis of the lateral cutaneous branch of the last dorsal nerve was made. At operation, after removing the scar, this nerve was dissected out and excised for a length of 5.5 cm. The patient was discharged, cured.

BREAST.—Carcinoma of the Breast.—There were 8 cases of mammary carcinoma, 1 in a male, and 7 in females. The right breast was affected in 6, the left in 2. Two of the women gave a family history of cancer, and 1 a history of trauma. Halsted's operation was performed in the 4 favorable, and simple removal of the breast in the 4 unfavorable cases.

The male patient, a tailor aged 48, had had a small lump in the right breast for 10 years. This caused no disturbance until

it began noticeably to grow 6 months before operation. Examination revealed a hard, irregular, non-encapsulated tumor the size of an egg, which was adherent and ulcerated. The nipple was retracted. Owing to his occupation, the breast alone was removed.

UTERUS AND APPENDAGES.—*Uterine Fibroids.*—There were 7 cases of uterine fibroids, in 6 of which abdominal and in 1 vaginal hysterectomy was performed; in 4 patients, all past the menopause, the hysterectomies were complete. Of the 2 incomplete, in 1 there was added a left intra-ligamentary cyst and a chronically inflamed appendix; in the other, the diseased right tube and ovary were removed with the uterus. The vaginal hysterectomy was performed in a patient aged 63, with Pryor's clamps. The clinical diagnosis of fibroids were all confirmed by microscopical examination.

Carcinoma of the Uterus.—There were 6 cases of carcinoma of the uterus, 2 involving the cervix and 4 the body of the organ. Complete abdominal hysterectomy was done in 5 cases, and vaginal hysterectomy, using Pryor's clamps, in one case. The youngest patient was the case of vaginal hysterectomy for squamous epithelioma occurring in a Polish woman aged 26 years.

In addition to the above cases of hysterectomy for carcinoma there were 5 cases of complete abdominal hysterectomy for infected uteri; one of which was complicated by a papilliferous adenomatous cyst of the ovary and a chronic appendicitis; the appendix was also removed.

Retro-Displacements of the Uterus.—Retroversion was present in 4 cases, and was corrected in 1 by Alexander's extraperitoneal, and in 2 by Tuffier's intraperitoneal shortening of the round ligaments, in 1 of the latter both ovaries and the left tube being diseased and removed. In another Mann's operation was performed.

A prolapsed uterus of 2 years' standing caused by a laceration of the perineum, was corrected by ventro-suspension and perineorrhaphy.

Extra-Uterine Pregnancy.—This interesting condition occurred in 6 patients, whose ages ranged from 20 to 35. Of these, 3 were primiparæ, 2 had borne children 6 years previously, and 1 had had 3 miscarriages. Two patients experienced sudden, sharp, cutting pain in the pelvis, one of whom fainted. Five of

the 6 gestations were right-sided and ruptured, and the other unruptured on the left side. Five were tubal and 1 tubo-abdominal. Three of the patients were irrigated with saline solution and drained by a glass tube in the pelvis, 2 were not drained, and 1, in whom a large cyst was found on the opposite side, was drained with gauze.

Diseases of the Tubes and Ovaries.—There were 7 cases of pyosalpinx, 4 bilateral in one of which the appendix was involved; 1 right sided in which the appendix was involved, and 2 left sided. Of 3 cases of chronic right-sided salpingo-öophoritis, the appendix was involved in one; 2 other cases were on the left side. Both ovaries were cystic in 1 case, and the left in another. There were 2 cases of left-sided ovarian cyst, in 1 of which was a small dermoid.

In addition to those operations described above, the following less interesting were performed at the clinics:

Abortion (curettage)	1
Abscess, perichondrial (post-typhoidal)	1
Abscess, ischio-rectal	1
Abscess (peri-urethral)	1
Adenitis, axillary, tubercular	1
Adenitis, cervical	2
Adeno-fibroma, breast	1
Adhesions, abdominal	2
Arthritis, knee, tubercular (excision)	1
Arthritis, carpi, tubercular (amputation)	1
Atresia of cervix	1
Carcinoma of cæcum (resection, ileo-colostomy).....	1
Carcinoma of sigmoid (ileo-sigmoidostomy).....	1
Carcinoma of tongue (unilateral excision).....	1
Cyst, suprahyoid	1
Cystotomy, suprapubic, for tuberculosis of bladder.....	1
Empyema	2
Endometritis (curettage)	3
Fissure-in-ano	5
Fistula-in-ano	1
Fracture of tibia and fibula, comp. and commin. (amputation) ..	1
Goitre, cystic (unilateral thyroidectomy)	1
Hæmorrhage, secondary following an abdominal section.....	1
Hæmorrhoids (clamp and cautery)	4
Hydrocele (radical)	3
Hypertrophy of cervix (amputation).....	1
Lacerated cervix (trachelorrhaphy)	1

Lacerated perineum (Emmet)	3
Lipomata	2
Myxofibroma abdominal wall and ileum (enterectomy).....	1
Neuralgia, tri-facial (neurectomy)	1
Retained secundines (curettage).....	3
Sarcoma of back	1
Sarcoma of parotid (extirpation).....	1
Stricture, urethral (dilation and perineal section).....	4
Supernumerary toe	1
Ulcer of leg, traumatic (excision and curettage).....	1
Urethral caruncle	1
Varicocele	2
Varicose veins of leg (phlebectomy).....	2
<hr/>	
Total	64

The deaths were: Acute appendicitis, 1; Carcinoma of cæcum, 1; Carcinoma of tongue, 1; Carcinoma of pylorus and pancreas, 1; Carcinoma of sigmoid, 1; Cholecystitis, 1; Empyema, 1; Tuberculosis of bladder, 1; Ulcer of stomach, 1.

GLANDERS IN THE HUMAN SUBJECT.

CLINICAL REPORT OF TWO CASES OBSERVED IN THE FOURTH MEDICAL DIVISION
OF BELLEVUE HOSPITAL OF NEW YORK.

BY JAMES TAFT PILCHER, M.D.,

OF NEW YORK.

CASE I.—B. C., age 30, Russian, stableman, was admitted to Bellevue Hospital, December 31, 1905, with the following history:

Six weeks previous to admission he was bitten in the thigh by a horse, which at that time was apparently healthy and has remained so. Two weeks later a new horse was purchased, which was taken ill in a few days and was attended by patient; after a week the horse was shot by order of the Board of Health, having developed cutaneous nodules and many points of superficial ulcerations; diagnosis, glanders.

Three days previous to applying at hospital the man went to work feeling perfectly well. During the afternoon he was seized with sharp, stabbing pains in left chest, posteriorly, which increased on deep inspirations; shortly afterward he had a short, dry cough; sputum normal, moderate dyspnoea, and increasing pains in left side. These symptoms becoming more insistent, he presented himself at the hospital and, on examination, showed:

A well-developed and well-nourished male; apprehensive and flushed facies; rapid, shallow, grunting respiration; skin hot and dry; general appearance of one acutely ill.

Lungs: Over left lobe, dulness; absent, vocal fremitus; diminished breath sounds and many coarse, crepitant rales. Otherwise negative, especially pharynx, nose and skin.

Appended is record of bedside notes, made by the writer, which will indicate the progress of patient's illness more in detail.

December 21.—Patient admitted. Temperature 103; pulse 104; respiration 28; with considerable oedema of lungs; under active and continuous stimulation and radical use of vaso-constrictors, this condition was relieved.

December 22.—Looks very ill; more so than would be indi-

cated by his physical signs. Temperature 103; pulse 120; respiration 52. Acts apprehensively, and is resistive on being moved.

December 23.—Pulse and respiration continue rapid; temperature rising. Complains of a good deal of deep-seated pain, no external evidences. Lung signs unchanged.

December 24.—During past twenty-four hours has been semi-delirious, and so restless that restraint has been adopted.

December 25.—Prostration progressive. Right knee held flexed, and is painful to palpation; is slightly swollen.

December 27.—Patient seldom moves; seems to have generalized pains. Right knee joint more swollen; back of right hand and outer aspect of ankle tender to touch.

December 30.—Right knee markedly swollen. Right hand and left ankle reddened, painfully hot. Pain on pressure over extensor muscles of legs and flexors of both arms, particularly right.

January 2.—Multiple tumefactions appearing on thighs, arms and legs; condition of ankle, knee and hand progressively worse. General condition critical; temperature, pulse, respiration going up. Breathing shallow, with inspiratory and expiratory stertor; is in great pain; dyspnoea increasing and more difficult.

January 3.—Died 1 A.M. Seemingly septic.

(See Chart A.)

Clinical Pathology.—On admission, white blood corpuscles 14,700; following day, 14,700; December 29, 13,700; ante mortem, 19,500.

December 30.—Widal examinations with negative results.

December 31.—Blood culture, showed at end of forty-eight hours on blood agar plates, numerous deep and superficial colonies, about 35 to a plate; the superficial ones being raised, whitish, opaque and viscid. The flasks showed a flocculent sediment which, on examination, showed a small, slightly bent, irregularly stained, gram negative bacillus, strongly suggesting *B. mallei*. Sub-culture on potato showed, after a few days, a characteristic raised, viscid, brownish growth.

Post-mortem examination, made ten hours after death, by Dr. Pappenheimer, showed a moderately well-nourished male, about 35, of medium frame. Small, superficial abrasion covered by scab, no area of inflammation, on external surface of right thigh. Over both arms, on dorsum of right hand, over left thigh

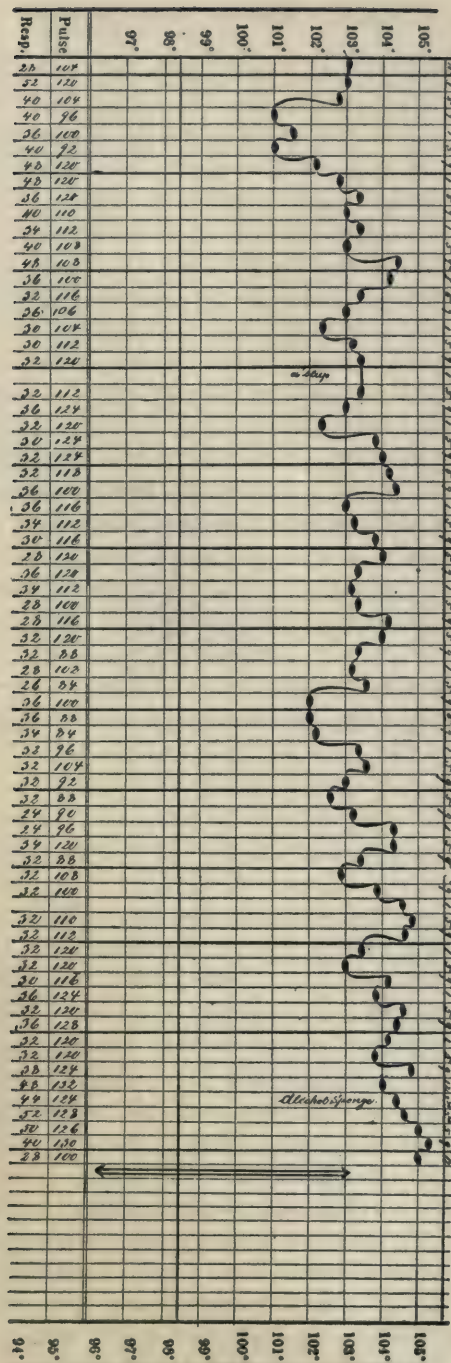


CHART A.

on external surface, and scattered irregularly over rest of body, are a number of deep-seated nodular swellings, showing as diffuse, rounded prominences of the skin, without external signs of inflammation. Section shows them to correspond to abscesses localized chiefly within the muscles and deeper layers of the corium. The abscesses contain a thick, yellowish white or brownish pus. There is apparently entire absence of inflammatory reaction about them, neither granulation tissue nor hyperæmia. Right knee swollen; on section, exudes thin, purulent fluid. Swelling over third right metacarpo-phalangeal joint; incision followed by escape of thin pus. Left lung adherent over the lower half of lower lobe to the chest wall. Right lung free.

Lungs.—Left lung: over lower portion of lower lobe, the pleura is thickened, showing patches of firmly adherent fibrin and superficial circular yellowish abscesses. Bronchial lymph nodes are small anthracotic, and the seats of calcareous deposits. Bronchi contain frothy fluid, otherwise normal. Parenchyma of the lung, save for moderate œdema, normal. Right lung shows moderate œdema.

Spleen.—Slightly enlarged, capsule tense. On section it is somewhat softer than normal; pale in color; no undue prominence of Malpighian bodies or trabeculæ.

Larynx.—Left aryteno-epiglottic fold and the mucous membrane in the pyriform fossa on the left side are markedly œdematous. There is a fine erosion of the left cord. The anterior wall of the larynx, just below the rima glottidis, shows a group of small submucous abscesses which exude thick, yellowish-white pus. These show no surrounding inflammatory reaction. M. M. of trachea elsewhere normal.

Stomach.—Shows numerous ecchymoses; slight swelling of the mucous membrane; in the pyloric half the mucous membrane is mammillated; this condition is marked also in the first portion of the duodenum. The heart, liver, pancreas, adrenals, kidneys, bladder and ureters, pharynx, small and large intestines, thyroid and brain are negative to any essential gross changes.

Anatomical Diagnosis.—*Pyæmia (glanders) and abscesses of muscles, pleuræ, and laryngeal mucous membranes*.—Smears were made from the laryngeal abscesses and from several of the subcutaneous lesions. Cultures were made from the spleen and from the pus in a deep nodule in the right arm. A guinea pig was

injected intraperitoneally with a broth suspension of pus from a subcutaneous abscess. The *B. mallei* was obtained in pure culture from the spleen and abscess, and bacilli having characteristic morphology and staining reaction were seen in smears from the pus.

The guinea pig showed, after twenty-four hours, slight swelling of the testicles which, at the end of seventy-two hours was very marked, the overlying skin being hot and glazed. Three days after injection the pig was killed; autopsy showed superficial abscesses in the seminal vesicles, and intense fibrinopurulent inflammation of the tunica vaginalis which was studded with small miliary abscesses. The testes proper were swollen to about twice their normal size. There was no peritonitis. Pure cultures of *B. mallei* were obtained in streak plates on glycerine agar from the peritoneal cavity and the tunica vaginalis.

CASE II.—H. M., age 55, stableman. Patient was admitted to Bellevue Hospital, April 4, 1905, in a delirious condition. No history was obtainable other than that he had been bitten on the top of the head about a week previously, and that for the last few days before admission his right arm and shoulder had become painful and swollen, and that he had become feverish and weak.

On examination, a well-developed and well-nourished male presented himself, apparently acutely ill; skin hot and dry, capillary ectasia over both cheeks and nose, ecchymosis under right eye. Spastic condition of right arm which, together with right shoulder, was greatly reddened, oedematous and very tender. On vertex of cranial vault is a small scalp wound about which the skin extending out in all directions is swollen, red, indurated and oedematous; the edges are irregular and separated from the healthy tissue by an abrupt stump edge. Further examination is negative other than the signs of a moderate bronchitis, and a generalized neuritis, pain on pressure being especially marked.

On April 7, forty-eight hours before death, a generalized pustular eruption was noticed, particularly over forehead, face, neck and right forearm. These foci showed only in a very few instances, as was noted also in Case I, the purplish hyperæmic areola about them, which is supposed to be so characteristic of the infection of glanders. Smears were immediately taken from the pus, and showed bacilli having characteristic morphology and staining reaction of the *B. mallei*. A guinea pig was injected

intraperitoneally, and showed the successive phenomena typical of this infection in these animals, as was described under Case I. Clinically, the patient simulated the condition of the first patient. The temperature, pulse and respiration ran along in the same ratio and degree. His leukocytes, on day after admission, were 10,000; red corpuscles 5,000,000; hæmoglobin 90 per cent. and differential; neutrophiles 80 per cent.; mononuclears 4 per cent.; lymphocytes 16 per cent.; eosinophiles 0. Urinary examination in both showed a fairly typical degree of acute toxic nephritis.

(See Chart B.)

Post mortem, done a few hours after death, showed on scalp over parietal and anterior occipital region a central defect covered with dried scab; around this an area four inches across with numerous prominent, yellowish foci, one-third mm. in size.

Over forehead are noted elevations, 1 mm. to 1 cm. in diameter, some with yellow head, and others open over the dome of the prominence. One on right eyelid, one on left cheek, several on neck and supraclavicular region; a large one 2 inches in diameter over lower end of sternum, fluctuating at centre, yellowish, surrounded by red zone; on incision, brownish, thick pus.

On sides of abdomen were small nodules; right forearm, abscess in muscle; on inner surface right thigh, also nodule of same type as in forearm.

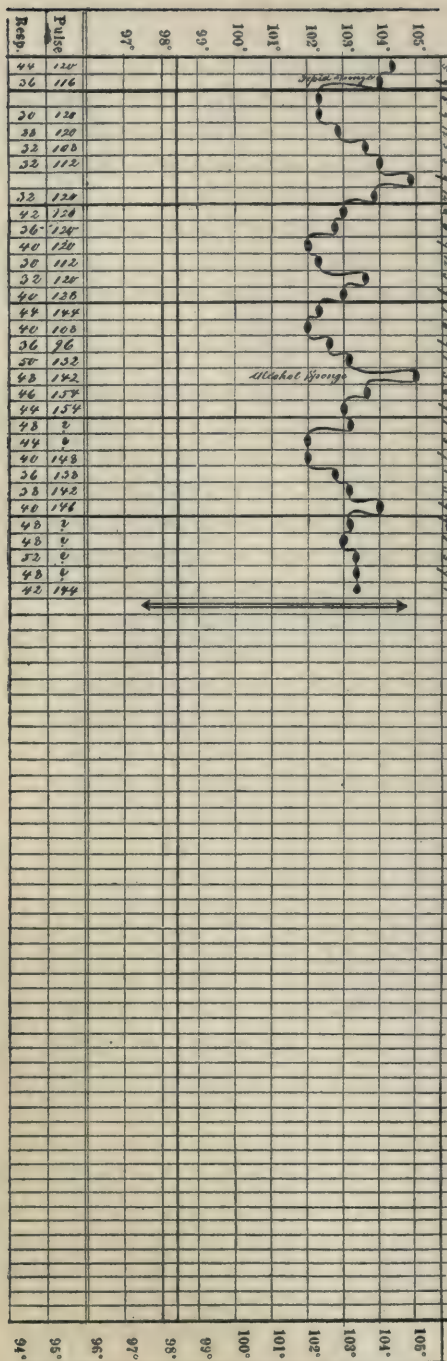
Under area of abscess described on lower end of sternum the bone shows yellowish infiltration of cancellous tissue; mediastinum shows quantity of yellowish-brown pus.

Head.—On section of scalp through area above described, the foci of suppuration are seen to extend down to the pericranium; the cellular tissue of the scalp, which is the seat of multiple abscesses, is œdematous; over the frontal bones just superficial to the pericranium are several groups of small, yellowish foci, each surrounded by a hyperæmic zone; calvarium normal.

Heart.—A few ecchymoses on pericardium, especially over left ventricle; muscle dark red.

Lungs.—Right apex adherent by old adhesions. On section, are seen numerous pustular foci, up to 3 cm., which on their pleural surface show yellowish centres with numerous smaller yellowish, pustular foci surrounding them, bounded by a hyperæmic zone; left presents the same lesions.

Tonsils enlarged to two-thirds cm.; œsophagus normal. On



posterior wall of pharynx, on ary-epiglottic fold, in pyriform fossa, on epiglottis, farcy buds up to 6 mm. in diameter. Tracheal and bronchial mucosæ normal.

Spleen.—Shows moderate degree of septic softening.

Stomach.—Mucosa is ecchymotic.

Kidneys.—Lesions of acute parachymatous nephritis.

Intestines.—Mucosa congested.

Other viscera negative to gross changes.

REMARKS.

Beyond question the infection in Case I occurred through inhalation. In Case II inoculation through the scalp wound was the probable cause. However, though infection occurred differently in both cases, the ultimate symptomatology and clinical findings show a marked similarity. In Case I the incubation period was 25 days; course before fatal termination, 13 days. In Case II the incubation was only 5 days, while the course before death was only 9 days, showing a variability in the length of time elapsing between infection and exhibition of symptoms, due, it may be inferred, to the mode of infection in conjunction with the virulence of the infecting organism.

In both cases the striking thing is the fact that the degree of prostration is greatly out of proportion to the physical signs; in both there were the signs of a diffuse bronchitis, more marked in the first case. Both cases exhibited the signs early of muscular pains, probably caused by the early formation of deep abscesses. The most striking phenomenon is the early involvement of the various larger joints of the body.

There seems to have been no exhibition of lymphatic involvement. The glandular nodules or pustules, in both cases, became a terminal development. The historical bluish-red areola about the cutaneous nodules was lacking in both cases. Clinically, is noticed the sustained temperature curve and the disproportion between the temperature, respiration and the pulse, the latter being, in both cases, much lower during the majority of the course than would be accounted for by the extreme degree of temperature and the acceleration of respira-

tion, the latter tending to make one infer that the disease involved the respiratory apparatus.

Clinically, the most noteworthy phenomenon is the relatively low leukocyte count, in the first case varying from 14,700 to 13,700 per cm., with an ante-mortem rise to 19,500 per cm. In the second case, at the very height of the disease, the count was but 10,000 per cm., while the differential count does not show any particular inflammatory reaction; which observations, in themselves, taken together with the extreme grade of obviously septic involvement, would tend to make one suspicious of the infecting agent immediately.

Fresh blood preparations allowed to coagulate, the supernatant serum being removed, tests similar in execution and technique to the familiar Widal reaction are found, in the case of the *B. mallei*, to cause a similar agglutinative reaction.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, December 12, 1906.

The President, Dr. GEORGE WOOLSEY, in the Chair.

SUPPURATIVE SYNOVITIS OF THE KNEE.

DR. CHARLES H. PECK presented a man who had been subjected to a transverse incision into the knee joint for the relief of suppurative infection. The case is reported in detail in the paper on page 409.

DR. JOHN A. HARTWELL presented a man, forty-eight years old, who was admitted to the Lincoln Hospital in May, 1903, suffering from an injury to the right leg, a heavy box having fallen directly across it. Examination showed a fracture of the tibia just below the head of the bone and a severe contusion of the joint itself. In the course of a few days the knee joint showed evidences of infection, with the usual septic symptoms. The infection was possibly due to the fact that the joint had been aspirated in order to relieve the tension.

As the septic symptoms increased in severity, a transverse incision was made across the joint, and the patella turned upwards. The ligaments, however, were not divided, as Dr. Peck had done in his case, and it was perhaps owing to that fact that the outcome of the case was not more favorable. In spite of the free exposure of the joint and thorough irrigations twice daily, with the knee flexed and the patellar flap drawn well upward, the case ran a very septic course, which continued for five or six weeks. The fracture of the tibia was a complication which rendered the treatment more difficult. The patient suffered much pain. Several ineffectual attempts were made to suture the patella back into

position, but each time the recurrence of the suppurative process underneath the bone would interfere with its reposition.

Ultimately the crucial ligaments and most of the lateral ligaments sloughed away so that a backward dislocation of the knee took place. Dr. Hartwell was inclined to think that a better result would have been obtained if the joint had been opened by free lateral incisions placed as far posteriorly as possible.

As a result of the injury and the prolonged suppurative process, the patient now had a stiff joint, with a good deal of deformity, but this did not interfere with his occupation as a shoemaker, and he was well satisfied that the limb was not sacrificed.

DEFORMITY OF THE SHOULDER JOINT.

DR. HARTWELL, through the kindness of Dr. A. S. Vosburgh, presented a girl of twelve, who three years ago was successfully treated by Dr. Lorenz of Vienna for a congenital dislocation of the hip. About a year later she awoke one morning, complaining of a disability of the right shoulder. There was no history of a fall or injury, and the function of the joint prior to that time had apparently been normal, although the child's parents had noticed that she usually slept on the right side, with the shoulder deeply burrowed in the mattress.

Since the onset of the trouble, two years ago, the disability of the joint had steadily increased. At the present time the acromion was very prominent, and there was distinct atrophy of the deltoid muscle. There was no reaction of degeneration in the muscle, and a certain amount of power still remained. There was practically no motion in the shoulder between the humerus and scapula. There had never been any pain. The shaft of the humerus was apparently normal, but the head of the bone seemed to be out of position. The humerus was nearly an inch shorter than on the normal side.

Dr. Hartwell said the patient had been examined by a number of surgeons and orthopædists, and various views had been expressed as to the nature of the condition. Some regarded it as a dislocation, others as a fracture of the anatomical neck of the humerus.

In connection with this case, Dr. Hartwell showed a radiograph of the shoulder taken by Dr. Wisner R. Townsend in February, 1906, and one taken at Bellevue Hospital in December,

1906. Dr. Hartwell had diagnosed tuberculosis of the humerus and advised operation, but this was refused because of the conflicting opinions which had been expressed by the different surgeons who had seen the joint.

DR. ROYAL WHITMAN did not think there were any evidences of a fracture. He regarded the case as the result of disease, the head of the bone having been destroyed by granulation tissue, "caries sicca." The process was probably of several years' duration. Cases of this character in which the progress in limitation of motion, stiffness, pain and resulting atrophy did not attract especial attention for a long time were not at all uncommon.

DR. V. P. GIBNEY said he was inclined to agree with Dr. Whitman that the case was one of tubercular osteitis of the shoulder joint, probably having its origin in early life. These cases, the speaker said, frequently went unrecognized until several years after the onset of the disease. In reply to a question as to the most favorable method of treatment, Dr. Gibney said he would suggest an arthroplasty, which might increase the range of motion. The operation was comparatively new, consisting of removing through long incisions the contracted tissue such as capsule and new bands followed by the interposition of fascia covered with fat, taking from the muscles, covering the bone eroded of cartilage with this fatty tissue—the object of which clearly was to prevent subsequent synostosis.

DR. HARTWELL, in closing, said he had been inclined to regard the case as one of tubercular disease of the shoulder, but there had been so many conflicting opinions that he had deemed it advisable to present the case for diagnosis.

STATUS OF A CASE FOUR MONTHS AFTER RIGHT NEPHROSTOMY.

DR. F. TILDEN BROWN presented an unmarried woman, forty-eight years old, who for two years had suffered from hæmaturia. She was first seen by Dr. Brown with Dr. Galbraith on July 15, 1906, at which time cystoscopy showed a bleeding neoplasm the size of a large hen's egg.

After the patient's admission to the Presbyterian Hospital, on July 20, three weeks were devoted to local and constitutional treatment in order to fit her for an operation, but her anæmia and

emaciation increased. The hæmaturia, foul cystitis and general sepsis were but slightly improved, her temperature frequently going up to 105. There was a tumor of the bladder which involved enough of the right vesical wall and the vesical portion of the right ureter to require such an amount of cystectomy as would cripple the corresponding kidney unless its damaged outlet was compensated for in some way. For this reason, lumbar drainage seemed better than ureteric transplantation to some other portion of the bladder, because a recurrence of the neoplasm might demand a subsequent and more extensive cystectomy. Consequently, on August 11, a right nephrostomy was done, which comprised placing two chromic ligatures on the ureter, an inch or so below the renal pelvis, and severing it between them; then making a punctured opening for a soft rubber angled catheter from the convex surface of the kidney into its pelvis. To do this in a normal kidney in which the pelvis was of course a small collapsed space, was attended with considerable difficulty and uncertainty unless the finger was called into requisition; needless to say, the finger was disadvantageously large. For this purpose, the proper resource was a probe to be passed into the proximal end of the severed ureter, and advanced through pelvis, calyx, parenchyma and capsule; then the probe tip was to be seized by dilating forceps, which were led back into the pelvis as the probe was withdrawn. Now, withdrawal of the partly opened forceps would afford a safe and adequate tunnel for the catheter.

After the drainage catheter was adjusted in the kidney, the fibrous and fatty capsule immediately surrounding the catheter were united to the wound opening in the upper angle of the lumbar fascia, for the purpose of coupling the parts and maintaining the future sinus in as direct a line as possible to the surface; the catheter was secured in place also by a silk suture to the skin.

By September 4 the conditions connected with the nephrostomy were satisfactory enough to justify operation for the bladder tumor, although the patient was in much the same septic and debilitated state, due to the putrid cystitis and the bleeding from the necrotic tumor.

With the patient in partial Trendelenburg posture, a suprapubic cystotomy was done, which disclosed a soft tumor, two

inches in diameter, with adherent blood clot and necrotic filaments. Its pedicle involved the bladder wall for an inch or more, and was in touch with and just below and behind the right ureteral mouth. To secure space for dealing with the bladder wall, the tumor was ligated as closely as possible, and cut away. An elliptical section of the bladder wall was made well beyond the margin of the pedicle; this, as had been anticipated, involved the intra-muscular portion of the ureter. The wound was approximated by chromic sutures in layers. The intravesical part of the operation, particularly the suturing, was materially facilitated by having the bladder floor lifted well up by an assistant's finger in the rectum, and by the illumination afforded by a small cold electric lamp passed through the urethra and held just clear of the internal meatus. Before closing the bladder wound of entrance, a soft rubber two-eyed catheter, led through the urethra, was secured in the most favorable position. The parietal wound was closed in the greater part, space being left for wick drainage of the perineal space.

After the operation, convalescence was very slow but nearly constantly progressive. On October 31, 1906, the patient was discharged practically well, and already quite competent to care for the lumbar drainage catheter and the glass urinal suspended at the waist, into which the catheter led the urine from the right kidney. There was no wetting of her clothes or body day or night. She removed the catheter daily for boiling. At the time the patient was shown by Dr. Brown, the urinal contained about two ounces of clear urine. She had regained her lost weight. She had just menstruated for the first time in six months and was able to perform all her duties as a housemaid.

In referring to the drainage tube in the kidney, Dr. Brown said it should be a right-angled soft rubber, two-eyed catheter, of from No. 18 to No. 22, French size. The short arm of the catheter was just long enough to reach from the skin margin of the fistula to the centre of the renal pelvis. This distance would vary in different individuals. A catheter of the exact size could be specially moulded at slight cost. The ordinary straight catheter would not be satisfactory for several reasons, one being that the pressure of the clothing would give it such a sharp angling or bend as to occlude its lumen.

DR. CHARLES L. GIBSON suggested that the woman's con-

dition might be made more bearable by removing the kidney. Anything, he thought, was preferable to this method of draining the kidney externally.

DR. BROWN, in reply to Dr. Gibson, said he did not see that enough would be gained by removing the kidney to justify it. The sole advantage would be to save the patient the trouble of caring for her catheter and wearing a urinal, especially in view of the even remote possibility of a nephritis developing on the opposite side. It was preferable, he thought, to have two sound kidneys, even with one of them draining into the loin than to have but a single sound kidney. Experience seemed to show that by this external method of drainage, the kidney was not exposed to the same danger of infection as it was when the ureter was sutured into abnormal positions.

In reply to the query as to whether there was much danger of the kidney becoming septic, Dr. Brown said there was less danger of this by the external method of drainage than there was when the ureter was transplanted into the bowel. Of course, the transplantation of the ureter into another section of the bladder was the ideal operation, but it was more theoretical than practical. Stricture formation, cystitis and disturbances of the urinary function were not infrequent complications of such successful anastomoses; moreover, the immediate risks that attended the success of implantation itself were not inconsiderable.

Dr Brown said he was interested in the ultimate outcome of the kidney drainage in this case. While the presence of the catheter in the pelvis of the kidney was doubtless a source of more or less irritation and chronic pyelitis, it had thus far in this case given no evidences of that fact. The smooth and perfect condition of the eye-end of the catheter is of importance in guarding against this possibility.

DR. CHARLES H. PECK said that he had recently seen a case where he had been obliged to resort to permanent lumbar drainage of the kidney as a life-saving measure. The patient was a woman who some time after a nephrectomy had an attack of complete urinary obstruction on the opposite side. A nephrotomy was done, and about 750 cc. of turbid urine withdrawn from the pelvis. The condition of the patient was such that a prolonged operation was not deemed advisable at the time, but it was concluded that the obstruction to the outflow of urine was due to a

kink in the ureter. After this operation, a ureteral catheter was introduced, through which there was free drainage, in addition to the lumbar drainage, but when the ureteral catheter was withdrawn five days later, no urine passed spontaneously. The quality of the urine drained through the loin gradually improved, and then the question came up of re-establishing the patency of the ureter. A ureteral catheter was again introduced, with a similar result. The kidney was again exposed with considerable difficulty, on account of the adhesions left by the previous operation, and a kink in the ureter was found near the junction of the ureter and pelvis. It was impossible to correct this, and a plastic operation on the ureter similar in plan to the Finney pyloroplasty was performed. While apparently satisfactory at the time of operation, the result proved unsuccessful. Permanent lumbar drainage was then resorted to as the last expedient. The operation was done on October 1, 1906, and when Dr. Peck last saw the patient, four weeks ago, the condition of the kidney was fairly good. He asked Dr. Brown whether permanent lumbar drainage of the kidney was compatible with prolonged life?

DR. BROWN said he could not answer Dr. Peck's question from personal experience. Dr. Watson of Boston had reported a case of double nephrostomy in a patient upon whom the operation was done eight or nine years ago, and who was still able to carry on the functions of an active business life without his associates even suspecting that he was wearing lumbar drains and urinals. According to Dr. Watson, these lumbar fistulæ showed no tendency to close. In fact, such would be impossible since the patency and even the continuity of the ureter was purposely sacrificed at the nephrostomy operation. In his own case, Dr. Brown said, the patient had gained many pounds in weight since the operation. She was a mere skeleton when she entered the hospital, and did not offer a very hopeful prospect of bearing a serious operation. Her menstrual periods, which had been in abeyance for eight or nine months prior to the operation, had returned. The speaker said that if he had known beforehand that a favorable report on the nature of the bladder growth would have been rendered by the pathologist, he would have been inclined to do a less radical operation, and would have limited himself to removing the tumor and leaving the bladder wall intact. Of course, the preliminary nephrostomy would not have been done.

DR. WOOLSEY said that in one case of accidental division of the ureter he had had very good success follow the implantation of the ureter into the bladder. The operation did not seem to be attended by any great degree of risk.

RENAL HÆMATURIA: NEPHRECTOMY.

DR. F. TILDEN BROWN presented a married woman, forty-seven years old, who came under observation on September 24, 1906, complaining of hæmaturia and right lumbar pain. Her father died of heart trouble. Her mother had long suffered from rheumatism. Two sisters died of pulmonary tuberculosis and the patient had a son who was suffering from that disease.

Personal History.—The patient had typhoid fever 19 years ago, and two years ago she gave an indefinite history of pneumonia. She had long suffered from severe, intractable headaches, and for many years she had had "stomach trouble," with vomiting after meals. She also complained of pains in the right lower abdomen and lumbar region on both sides, radiating along the thighs to the knees. These pains were of an indefinite character and so severe that they would often confine her to bed in the morning, abating in the afternoon. The pains were aggravated by riding on a street car, and were usually eased when in a sitting position by crossing the right leg over the left knee.

Some months ago the patient had an unusually severe attack of this pain, which kept her in bed for two weeks. There was no history of chills or fever. There was urinary frequency at times, and pain at the beginning of the act. In July, 1906, she had a severe attack of diarrhœa and cramps, and during the summer she lost considerable weight. There was no history of jaundice nor dropsy.

Nine days before coming under observation the patient first noticed that there was blood in the urine. This was subsequently verified by passing the urine into a glass. No clots were noticed. That evening she had a violent attack of vomiting and pain in the right lumbar region, high up, and radiating down the side toward the groin and across the back. Since then, every passage of urine had been bloody. There had been only slight frequency and pain on urination. The hæmaturia was not influenced by rest or posture. There had been frequent recurrence of the vomiting.

The patient was admitted to the Presbyterian Hospital on

September 28, 1906. Physical examination showed a well-nourished woman. She was slightly anæmic, but did not look very ill. Her chief symptoms were hæmaturia, and pain in the right lumbar region. An examination of the abdomen was practically negative, although upon bimanual palpation there was an indistinct sense of a mass in the right flank, which descended from beneath the costal arch on deep inspiration. The character of this mass could not be made out.

An examination of the separate urines showed bloody urine from the right ureter, while that from the opposite kidney was practically normal. Cultures made from the urines of both kidneys remained sterile. An X-ray examination gave negative results.

The case was regarded as one of hæmaturia of undetermined origin, and on October 1, 1906, the right kidney was exposed. The kidney was of normal size, and in fairly good position. The surface of the kidney was somewhat lobulated, and disclosed three reddish areas which were slightly raised above the level of the surrounding kidney tissue. Dr. George A. Tuttle, the pathologist of the hospital, thought they were infarcts, although not typical of that condition. The kidney, as well as the pelvis and ureter were thoroughly explored, with negative results. Although no calculus nor other abnormality was found to explain the hæmaturia, removal of the kidney was deemed essential, and this was done after opening the peritoneum and examining the adjacent abdominal organs. These showed no abnormalities.

The woman made a rapid recovery after the operation, and left the hospital on October 27. There had been no recurrence of the hæmaturia. The pathological report of the excised kidney had not yet been satisfactorily completed.

TRANSVERSE INCISION OF THE KNEE JOINT FOR DRAINAGE IN SEVERE INFECTIONS.

DR. CHARLES H. PECK read a paper with the above title, for which see page 409.

DR. ROBERT F. WEIR said that in the two cases observed by him comparatively recently, which were referred to by Dr. Peck, and in which he had confined himself to the repair of the damage done to the joint by the disease and by the surgical efforts required to control the ensuing sepsis, his attention had been strongly

attracted by the difficulties that were encountered in bringing about a proper ambulatory support. So far as he then knew, only a resection of the joint along ordinary lines would answer, but this was not an easy matter in a child, where one is limited to the removal of quite a narrow margin of bone in avoiding the epiphyseal line, while the sub-luxation and the contracted tendons demanded a considerable space for the proper apposition of the denuded bone surfaces. Moreover, the turned-up flap of the patella and its coverings will not readily come down, and the replacement of the flap is only to be effected by taking out the patella and freely loosening the adjacent skin from its subjacent attachments. However, Dr. Lilienthal's method of removing the patella and splitting the flap at the time of employing the drainage might possibly do away with that difficulty.

Dr. Weir said that on referring to the original report of this method of drainage by Dr. Charles H. Mayo, he found that he simply cut freely through the patella, and thereby widely opened the joint, which was irrigated and packed with gauze, and the limb fixed on a splint. Subsequently, an article on this subject was published by Dr. William J. Mayo, in which he advised the transverse incision to go lower down, so as to divide the patellar ligament. No statement was made, however, about dividing the lateral or crucial ligaments, and nothing was said in regard to elevating the patellar flap. In that article, however, Dr. Mayo stated that he re-sutured the divided patellar ligament at the end of several weeks, and that particularly in children he was able in a number of instances to regain motion in the joint amounting to from 15 to 65 degrees of the normal range. To assure himself on these points in the surgical technique, Dr. Weir said, he had recently put himself into communication with C. H. Mayo, and had learned from him that his inferences were correct. Dr. Mayo had informed him that the crucial ligaments were not divided; that he only divided the capsule and the patellar ligament over the anterior half of the joint, and that the patella was not sutured.

If such authorities as these. Dr. Weir said, could get such good results and such a desirable degree of motion with a minimum amount of surgical damage, was it not possible that some of Mayo's willing followers had out-Heroded Herod and violated Talleyrand's injunction of showing too much zeal in dealing with these cases.

In concluding his remarks, Dr. Weir said it seemed to him that the following deductions were justifiable:

(1) That as the simpler, large double lateral openings of the joint (*i.e.*, running up to the top level of the capsule) would suffice for packing and drainage in the majority of cases, that method should be the one first tried in dealing with a suppurative arthritis.

(2) That if more radical efforts were required, the Mayo method should be resorted to, *i.e.*, transverse section of the anterior half of the joint, with irrigation and packing, together with flexion (not to an extreme point) of the limb on a splint, conjoined, in special cases, with popliteal drainage.

(3) In rebellious or progressively septic cases, endangering life, a wide open (utterly destroyed) joint, with uplifted patellar flap and extreme flexion, should be resorted to. Here the crucial and lateral ligaments should be divided.

In the first and second instances, there would be some hope of a more or less useful joint. In the last, only resection or amputation could be the outcome, if life was saved. Furthermore, in opening an acutely suppurating joint it is suggested that the flap method be reversed and the incision starting from a point a little below the articular line and in front of the lateral ligament should run across the joint at the top level of the capsule and terminate at a corresponding point on the other side of the articulation. This flap would open up best the area hardest to drain and if necessary, beside the irrigation and packing that follows the incision, it can be deflected with more ease than the one of Mayo and, better still, be more readily replaced by reason of its thinner base. It would permit likewise the coincident or subsequent division of the ligaments if this should be desired.

DR. GEORGE E. BREWER said he had had four cases of septic infection of the knee joint, three of which were referred to by Dr. Peck. In at least one of those cases there was a very severe grade of infection, and he did what had been spoken of as the typical Mayo operation. He removed the crucial ligaments, but did not turn back the flap. The patient improved somewhat, but in spite of posterior drainage the suppuration persisted much longer than in those cases where he opened the joint more widely. Dr. Brewer said that if this case had been operated on earlier, the measures that were resorted to might have sufficed.

In a case which he showed at a meeting of this Society two or three years ago, the patient, while drunk, had fallen against a rock, and sustained a ragged, contused wound involving the knee joint. Simple drainage was tried for a day or two, but the infective process was so virulent and extended so rapidly that a radical operation was done. After four or five weeks the suppurative process came to an end without the formation of any secondary abscesses. A resection was then done, and after bringing the two cut surfaces into apposition, the skin was united loosely over the wound and a wet dressing applied. The wound healed by granulation and further recovery was uneventful.

DR. V. P. GIBNEY said he recalled one case of acute infection, secondary to tuberculosis of the knee joint, where he opened the joint by a transverse incision. In spite of this the suppurative process persisted, and amputation became necessary as a life-saving measure. The Mayo operation, the speaker said, had not appealed to him in the class of cases that came under his observation. He rarely saw cases of acute suppurative arthritis in adults or adolescents. He occasionally met with the condition in infants, and in those cases he usually found that prompt incision, freely opening the joint, gave very satisfactory results, sometimes with resoration of function.

DR. ROYAL WHITMAN asked Dr. Peck if he had had any experience in the treatment of secondary infection of tuberculous knee joints by this method? The speaker said he had found those cases very difficult to drain. The tissues of the joint, as a rule, were thickened and spongy, and while the immediate results of this radical operation were usually good, the exuberant granulations soon filled the wound and destroyed the exposed area. These became infiltrated with pus, so that drainage might be worse than before.

DR. GEORGE D. STEWART said he recalled several cases in which he had operated on the knee joint somewhat after the manner described by Dr. Peck. The first case, which he saw several years ago, was one of severe infection of the joint in a child. It was operated on by the so-called Mayo method, but the result was not very satisfactory, and a resection was ultimately necessary.

The second case was that of a penetrating wound of the knee joint in an adult. Suppuration occurred, and after pro-

longed drainage had proved unsatisfactory, the joint was widely opened, the crucial and lateral ligaments divided, leaving nothing but the ligament of Winslow. The wound was irrigated and packed, and subsequently the joint was resected and the skin sutured loosely, after the manner described by Dr. Brewer. The patient made a good recovery, with a useful limb.

In speaking of popliteal drainage of the knee joint, Dr. Stewart said that he had never found it effective, so far as his experience went, even in the milder forms of infection. The muscles always drew the bones backward, and shut off drainage. In such cases, by flexing the knee slightly, access could be secured to the posterior pockets by going under either lateral ligament. A tube introduced in this way would not be compressed by the bone and would drain fairly well. Ideal drainage of this joint he did not believe possible.

The third case was one which Dr. Stewart, just before leaving on his vacation, turned over to a colleague for operation. The joint was widely opened and packed and when Dr. Stewart next saw the patient, about six weeks later, granulations had sprung up everywhere except over the articular cartilages; these, remaining, made it impossible to straighten the limb and delayed the progress of the case. Because of this and the increasing posterior displacement it was necessary to excise the joint practically after the method described by Dr. Peck; the result was prompt and satisfactory. Because of the delay occasioned by the articular cartilages, Dr. Stewart believes it best in any of these operations to remove the cartilages after the acute infection has subsided.

DR. WOOLSEY said that after seeing a case of this kind which was shown by Dr. Gerster some ten years ago, he had been induced to resort to the procedure in two or three instances. One of them was particularly interesting, as the infection of the knee joint followed a fracture of the patella which had been sutured subcutaneously. Coincident with the infection, there was necrosis of the patella. Lateral openings were first made, but as these proved insufficient, a joint flap was made and turned back. The crucial ligaments were not divided. The result was fairly satisfactory.

DR. PECK, in closing, said he had never applied this method to tubercular joints, nor had he seen it applied in such cases. He

was inclined to agree with Dr. Whitman that in dealing with tubercular infections of the joint, the method would not possess the value that it had in suppurative cases.

In regard to the method in general, Dr. Peck thought that the cases of knee-joint infection could be divided into three classes: First, that large proportion of cases which could be controlled by lateral incision and drainage. According to the figures given by Flint, from 70 to 80 per cent. recovered by that method with a fair amount of motion. Second, the typical procedure of Mayo was indicated in a certain proportion of cases, more particularly, it seemed to the speaker, in children, in whom the reparative processes were comparatively active. Third, in cases similar to his own, or to those reported by Drs. Brewer and Stewart, where the process was destructive or the infection was of a very virulent type, the proper operation was the complete one, with division of the crucial ligaments and eversion of the flap, thus completely exposing the posterior recesses of the joint. The latter were capable of containing a great deal of pus and of seriously interfering with complete drainage unless the crucial ligaments were divided. Popliteal drainage might answer the purpose in some cases, while in others lateral drains inserted under the lateral ligaments might prove satisfactory without division of the crucial ligaments, but in most of the severe cases the complete operation was demanded, and it should only be done as a preliminary to resection.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held December 3, 1906.

The Vice-President, DR. ROBERT G. LECONTE, in the Chair.

SUBPHRENIC ABSCESS FOLLOWING APPENDICITIS.

DR. JOHN H. JOPSON presented a man who had walked into the Presbyterian Hospital, three months previously, suffering from acute appendicitis. Operation was performed at once and revealed a generalized peritoneal inflammation with much free pus and a perforated and gangrenous appendix. The appendix was removed and the abdominal cavity freely drained, the patient treated by a modified Murphy treatment,—that is, frequent rectal injections of salt solution and the exaggerated Fowler position. The condition of the man after the first day or two caused no anxiety until several days later when a persistence of temperature of 100° to 102° , without apparent cause, attracted attention. The wound was explored, without revealing a pocket of pus and there was no pelvic collection. Finally, dullness could be demonstrated posteriorly over the lower portion of the right chest, but all other signs typical of a subphrenic collection were lacking. There appeared no other cause for the symptoms, but the man was not physically depressed, and Dr. Jopson was loath to believe that subphrenic abscess was present. At the end of two weeks the chest was tapped without obtaining any fluid. The fever continued and after persisting for four weeks it was decided that there must be a subphrenic abscess. Dr. W. E. Hughes, who also saw the patient at this time, gave as his opinion that there was pus somewhere between the upper surface of the liver and the lower portion of the lung. Before operation could be performed

the patient expectorated a large quantity of foul pus, the temperature rose to 104° , respiration and pulse became more rapid and the patient showed evidences of shock and sepsis. There evidently had been rupture into the lung. Dr. Jopson thought the pus had first gone into the general pleural cavity. He decided on account of the shocked condition of the patient to wait 24 hours before operating, but again aspirated, this time in the tenth interspace posteriorly, and obtained several ounces of fetid pus. He intended operating the next day but the patient suddenly became worse, with dyspnœa and very rapid pulse, there evidently being an acute effusion in the right pleura. Operation was performed the same day under local infiltration anæsthesia, an intercostal incision being made posteriorly between the tenth and eleventh ribs. A pint of cloudy serum was evacuated from the pleura and the opening made in the diaphragm by the needle observed. This was dilated by the finger, and the subphrenic collection drained. Rubber drainage was inserted into both the pleura and the abscess cavity. The drainage furnished by this incision was not considered satisfactory but the patient's condition was bad and it was made to suffice. The man did well after the operation and now only a small sinus remains. The pleura has closed and there is resonance down to the site of incision.

Appendicitis, the etiological factor here, is probably the commonest cause of subphrenic abscess, and this is especially true in children, as Dr. Jopson had emphasized in an analysis of 23 cases of subphrenic abscess in children which he had made several years ago. The diagnosis was obscured by the absence of constitutional symptoms except fever, and the indefinite nature of the physical signs. The pleura was infected at the time of the second operation, possibly by leakage from the point of aspiration, and it was not necessary to protect it by suture or packing, and this rendered drainage of the abscess feasible by local anæsthesia. The experiments of Noetzel apparently show that the pleura is more resistant to infection than muscle or skin, but this resistance is broken in the presence of a pneumothorax. Clinically, the pleura seems to be very susceptible of infection.

DR. WILLIAM L. RODMAN said Dr. Jopson was correct in saying that the majority of subphrenic abscesses are found in connection with suppurating appendicitis. Formerly it was regarded as most frequently caused by perforating gastric ulcer,

but Körte, in his masterly review of the subject, showed that the vast majority were due to suppurative lesions of the appendix. He prefers to employ the transpleural route in evacuating the abscesses, and undoubtedly that was the better method in Dr. Jopson's case.

CAVERNOUS ANGIOMA OF THE UPPER EXTREMITY.

DR. ASTLEY P. C. ASHHURST presented a girl, twelve years of age, whose right arm was the seat of a diffuse cavernous angioma. For his description of the case and remarks upon the condition, see paper on page 419.

DR. RICHARD H. HARTE said that in a worse case than that shown by Dr. Ashhurst he had used hot water injections after the method of Wyeth, but this produced no effect. He thought at first there was some improvement but the final result was no gain.

DR. WILLIAM L. RODMAN has used hot water injections in four or five well-marked cases of cavernous angioma with improvement in one or two but no cure. He considers the procedure dangerous, as embolism may result, and it does not promise satisfactory effects. His preference is for excision. If one keep well out in the healthy tissue there is no more trouble than in removing a solid tumor.

FRACTURE OF THE CORACOID PROCESS OF THE SCAPULA CAUSED BY MUSCULAR ACTION.

DR. ORLANDO H. PETTY presented a man who had sustained a fracture of the coracoid process of the scapula from muscular action. For the description of the case and remarks upon the condition, see page 427.

DR. GWILYM G. DAVIS said there is evidence to show that almost any bone in the body may be broken by direct violence, and so may the coracoid process. Dr Allis has produced this fracture by manipulation of the humerus; the break may possibly be caused by tension of the muscles inserted into the process, the coracobrachialis and short head of the biceps. The injury is probably often overlooked in dislocation of the humerus on account of the greater injury to the joint. The progress of the head of the humerus upward is stopped by the coracoid process, hence one would expect to find fractures of the process in these cases of dislocation.

DR. ADDINELL HEWSON was inclined to disagree with some of the statements made by Dr. Davis. The capsule of the shoulder joint is thickened at the base of the coracoid process by the coracohumeral ligament and above this is the coraco-acromial, a stout ligament connecting the coracoid and acromion processes. In forcible pushing upward of the head of the humerus, the head strikes the coracohumeral ligament and is thus prevented from striking the coracoid process. The weakest point in the capsule is below the coracohumeral ligament. With the patient holding on the car by one hand and with the other pulling on a man, action on the coracoid process would be exerted by the coracobrachialis, the short head of the biceps and the pectoralis minor. The conoid and trapezoid ligaments fix the body of the process, leaving the side and top to be acted on by the muscles. The ligaments have no effect in staying the action of the muscles. If the humerus be placed at right angles to the body and force is applied from behind, the humerus would be forced against the coracoid, and the short head of the biceps and the coracobrachialis would snap off the tip of the process.

REPORT OF THE SURGICAL CLINICS FOR STUDENTS AT
THE GERMAN HOSPITAL, 1905-1906.

DR. JOHN B. DEEVER presented this report, for which see page 431.

PERFORATION OF THE BOWEL IN TYPHOID FEVER.

DR. CHARLES F. MITCHELL reported eight cases of typhoid fever operated upon for perforation. He referred to the recent articles by Drs. Harte and Ashhurst on "Intestinal Perforation in Typhoid Fever" (*ANNALS OF SURGERY*, vol. xxxix, page 8), and the monograph by Dr. J. A. Scott, entitled "A Study of Fifty Cases of Perforation in Typhoid Fever" (*University of Pennsylvania Medical Bulletin*, May and June, 1905), which treated every phase of this subject in minute detail.

Seven of the eight cases occurred at the Pennsylvania Hospital; and he was indebted to the surgeons of that institution for the privilege of operating upon and reporting them. The other case was operated upon at the Germantown Hospital.

Three of the cases are mentioned in the article by Drs. Harte and Ashhurst and five were reported by Dr. Scott.

The history of the various cases was as follows:

CASE I.—R. P., aged 28 years; colored; hospital No. 2454; admitted October 31, 1902. Perforation, operation, and death on November 6. Had chancre within two years, used alcohol freely, and had malaria several times. Admitted to medical ward after seven days illness characterized by headache, diarrhœa, and daily chills for five days. The urine showed hyalogramular casts, and the spleen was palpable. Had moderately severe attack. On October 3, at 3 A.M., he was aroused from sleep by sudden abdominal pain (tenth day of disease) situated in both lower zones. This was the first abdominal pain complained of since his illness began. He vomited his milk; pulse became more rapid; the belly was not rigid, but generally tender. By 5.30 A.M. he vomited greenish mucus. There was moderate tympanites present, most marked in lower zones. Rigidity was now distinct, especially on the right side; slight tympanites. Doubtful movable dullness in the flanks. Breath sounds heard distinctly over abdomen as low as umbilicus. Liver dullness was absent in mid-clavicular line, present in axillary line. Leukocytes at 6.15 A.M., 11,360. Operation at 7.30 A.M. Perforation in ileum six inches above ileocæcal valve the size of a slate pencil. Death from general peritonitis. Autopsy.

CASE II.—A. A., aged 28 years; white; hospital number 138; admitted April 4, 1903, discharged June 25, 1903. Had malaria ten years ago, denies venereal disease. Began to feel badly three weeks ago, worked until two days before admission. Had chills, headache, cough, no epistaxis, no diarrhœa. The abdomen was soft and not tender; temperature about 103.1°. The day after admission he complained of abdominal pain; abdomen was rigid and tympanitic, but relief was obtained by the rectal tube. On April 8 he had two bloody stools and after a week the fever began to remit, while the abdomen became painless and soft. On April 10 there was evidence of rough breathing at both bases, with fine rales, and he complained of sharp pain over the left base on deep inspiration or cough. One week later the temperature touched normal, though he still complained now and then of chest pain. On April 19 (the thirty-sixth day) the temperature rose suddenly, and he had severe pain over the costal region, where an occasional friction rub could be heard. The following morning the expression was anxious, the abdomen was very rigid but not

tender. There was no vomiting and the temperature was not altered. Diagnosed perforation, and operation done at noon. No perforation or peritonitis found and no pain was experienced after operation for four or five days. Distinct symptoms of consolidation of the left base subsequently appeared. The patient made a good recovery.

CASE III.—A. G., aged twenty-one years; hospital number 1602. Admitted August 25, 1903. Perforation, operation and recovery. Discharged November 2. Entered the medical ward on the tenth day of typhoid. The temperature was high at the start, but was soon controlled by baths. The abdomen was soft and not tender; spleen readily palpable and tender; active bronchitis. At 6.30 P.M. on August 31 (sixteenth day) he complained of sharp pain on the right side of the abdomen, which was very tender; the recti were somewhat rigid; he had neither chill or vomiting. By 9 P.M. all the symptoms had increased in severity; leukocytes were 9,600. Perforation diagnosed; operation; perforation in ilium found. This patient made a good surgical convalescence; the temperature fell and remained down for seven days after operation. On the thirty-third day the temperature again rose and the patient suffered a true relapse.

CASE IV.—F. P., aged eighteen years; admitted November 9, 1903. Perforation, operation and recovery. Admitted with a history of a mild typhoid of thirteen days' duration. At 12 noon on the fifteenth day of his disease he had sudden severe abdominal pain, tenderness on the right side, spasm of the right rectus, costal respiration, and complete obliteration of liver dulness. At 3.30 P.M. the leukocytes had arisen to 17,600; at 5 P.M. they were 16,500, and at 7 P.M. 13,400. The temperature, which was 100° at the time of the first pain, fell to 99.2 at 1.30 P.M., remained the same at 2.30 P.M. and by 3.30 P.M. had arisen to 103.3°. The operation was performed eight hours after perforation and showed free gas in the peritoneum, the presence of fluid, and a perforation in the ilium. This was a so-called typical case of perforation in which all the symptoms were present and the blood findings conclusive. This patient recovered.

CASE V.—H. C., aged twenty-eight years; admitted October 12, 1904. Typhoid perforation, operation, recovery. Discharged January 4, 1905. Entered ward on eighth day of typhoid, the onset of which was marked by fainting attacks and daily

chills until the day of admission. He had some abdominal pain, the belly was normal, the spleen palpable. On the day of admission he had a chill followed by high temperature. No malarial parasites were discovered after a careful search. The temperature range was high, though he responded readily to tubbing, but had frequent chills after being in the water. The baths were stopped on October 16 and sponges substituted, from which time he had no chills. On October 15, the eleventh day, he complained a great deal of abdominal pain. Nothing, however, developed. On October 25, the twenty-first day, he had a small hæmorrhage which did not seem to affect his general condition. He was delirious at times and very stupid. On October 30, the twenty-sixth day, at 5.30 P.M., he cried out with pain in the right side below the level of the umbilicus but radiating through the abdomen. No rigidity was present and a hot water-bag gave relief. Two hours later there was a slight rigidity of both recti, especially the right. He vomited greenish fluid. The pain continued at intervals and his condition remained the same until between 2 and 3 A.M. The leukocytes at this time were 5,900. At 3 A.M. he had another paroxysm of pain, the abdomen was slightly distended and tender, the liver dulness gone, the flanks clear. There was abdominal breathing, but the right rectus was distinctly more rigid than the left. Operation at 3.30 A.M. Cloudy fluid in abdominal cavity, perforation the size of a lead-pencil eighteen inches above the cæcum, in the centre of an ulcer the size of a five-cent piece found. The patient reacted well and continued to do well until the eighteenth day after operation when a fæcal fistula developed. This finally closed and he was discharged on January 4, 1905.

CASE VI.—G. A., aged twenty-six. Admitted August 22, 1906. Operation. Death August 30, 1906. Illness began about one week before admission, with headache, nose-bleed, anorexia and general malaise. The bowels were normal. On admission tongue was slightly coated, tip red, spleen enlarged, rose-colored spots, and iliac tenderness. Widal reaction positive; leukocytes count 8,070. Five days after admission had hæmorrhage of eight ounces, temperature falling to normal six hours after expelling hæmorrhage. The following day, at midnight, after taking his medicine, he vomited several times, broke out into a cold sweat, and complained of pain in right iliac region. The abdomen was

tender but there was no distention. Leukocyte count 9,870. On the following morning, August 29, at 8 A.M. the belly was very tender; had cough and vomited several times. Was tender over the whole abdomen but it was more marked over the right side. The temperature at this time was 102° , pulse 128 and thready in character. Operation was done at 12 noon, abdomen opened in right semilunar line and a perforation found the size of a pin-head in the ilium eight inches above the ilio-cæcal junction. This was closed with linen thread and abdominal cavity flushed out with normal salt solution. Gauze drains were used. The patient did fairly well for twelve hours but suddenly collapsed and died the following day, thirty hours after operation.

CASE VII.—F. M., aged twenty-eight years, admitted October 21, 1906. Perforation; operation. Died October 23. Unable to obtain full history, as patient did not speak English. Sent in with diagnosis of appendicitis; had not been feeling well for two weeks previous to admission but had not been confined to bed. Brought to hospital by ambulance at 11.35 A.M. with only the history of a sudden severe attack of abdominal pain the previous evening. On admission the temperature was 103° , the abdomen extremely rigid and tender all over, liver dulness present. The general appearance of the patient and the history of not feeling well for two weeks suggested the diagnosis of perforated typhoid ulcer instead of appendicitis. Operation was done within two hours after admission and pin-point perforation in ilium about four inches above ilio-cæcal valve found. Opening closed with silk sutures, peritoneal cavity not flushed with salt solution but merely drained with strips of gauze. Patient did fairly well for fifteen hours when a change for the worse set in and he died about thirty-six hours after operation.

CASE VIII.—J. C., twenty-eight years of age. Admitted November 17, 1906. Perforation, operation, death November 27. Family and previous history negative. Eight days before admission was seized with severe headache, complained also of feeling tired but did not go to bed until three days later. Had several attacks of vomiting, nose-bleed, cough; no diarrhœa. On admission temperature was 103.3° , patient seemed very dull, physical examination of chest negative, spleen enlarged but not palpable, abdomen distended but not rigid or tender. Urine examination showed the presence of a small amount of albumin and a con-

siderable number of dark and pale granular and hyaline casts. Condition remained about the same until the morning of the twenty-first when, about 11 A.M., he complained of abdominal pain; there was a little more distention, and slight rigidity of the right rectus was noted. Bladder seemed distended, catheter was passed and seventeen ounces of urine were drawn off. This seemed to relieve the pain somewhat. Leukocytes 6,450. At 2 P.M. leukocytes were 3,800, temperature 102.2°, pulse 102, breath sounds could be distinctly heard over the abdomen which was exquisitely tender, and there was considerable rigidity of the right rectus. Liver dulness was practically obliterated. At 7 P.M. temperature was 103.1°, pulse 106, respirations 42, tongue and lips dry, had not vomited but had been belching a great deal. The abdomen was greatly distended, liver dulness entirely gone, dulness in flanks, the whole abdomen was extremely tender and both sides were equally rigid. Operation. Abdomen opened in right semilunar line, immediately upon which there escaped a considerable quantity of cloudy fluid which was found to entirely fill pelvis. A perforation the size of a pin-head was found in the ilium about four inches from the cæcum. This was closed with linen thread and the whole abdominal cavity flushed with salt solution. Drains of gauze were introduced. The patient did well for five days following operation, the temperature remaining about 99, and the pulse being fairly strong. On the beginning of the sixth day after the removal of some of the drains he complained of pain in the abdomen, the temperature became elevated and he gradually grew worse, dying on the morning of the seventh day. Autopsy showed that the stitches closing the perforation had failed to hold; the presence in the pelvis of considerable pus, also a double lobar pneumonia.

Résumé.—All the cases operated upon were males; their ages ranged from eighteen to twenty-eight years; five of the eight cases being twenty-eight years old. In one case operated upon no perforation was found. This case recovered. Of the remaining seven cases, four died and three recovered, a mortality of 57.1 per cent. The first symptom of perforation appeared in three of the cases on the fifteenth day, and in the other five cases on the tenth, twelfth, twenty-first, twenty-sixth, and thirty-sixth day respectively. Hæmorrhage from the bowel preceded perforation in three of the cases, being very slight in two, while in the third it

amounted only to eight fluid ounces. One of the cases that recovered had a slight hæmorrhage.

The time between perforation and operation had been reckoned from the first onset of pain; in the cases that recovered it being $4\frac{1}{2}$, 8 and 10 hours, while in the four that died it was 3, 8, 12 and 15 hours.

The leukocytes were counted in all but one case, and all showed a leukocytosis except in one of the three that recovered, which had a count immediately before operation of 5,900. In the case which had the highest count there were 17,500 leukocytes three hours after the first symptom, two hours later 16,500 and two hours still later or seven hours after perforation had taken place there was a count of 13,400. In the last case, operated on November 21, 1906, at the time of the first sign of trouble the count was 6,450, three hours later it was 3,800, and just previous to operation, or eight hours after the first symptom of perforation, there were 9,000 leukocytes.

None of the cases had more than one perforation; four were pin-head size, one the size of a lead-pencil and one that of a slate pencil. In one case the size of the perforation is not mentioned in the history.

It is interesting to note that the case which had the largest perforation was one of the three that recovered. The last eighteen inches of the ilium was the seat of the seven perforations.

The various operations were done under ether anæsthesia, incision made either through the outer border of the right rectus or through the right semilunar line. Fine silk was used to close the perforations except in two instances when linen thread was used. The abdominal cavity was flushed with salt solution in two of the cases, both of which died. Gauze drainage was used in every case and the wounds left entirely open to permit free drainage.

DR. RICHARD H. HARTE said that the figures presented by Dr. Mitchell were very materially below the general mortality in typhoid perforation. Through Dr. Mitchell's large experience at the Pennsylvania Hospital he has acquired ability of high order in the diagnosis of perforation. An important point of technic following operation has been emphasized by Dr. Mitchell. It is the custom of some surgeons after closing the perforation to flush the abdominal cavity with salt solution. This Dr. Harte

believes to be bad surgery as it disseminates septic material. In cases with a small perforation and in which operation is performed reasonably early, irrigation is a mistake, it being applicable only in cases in which extensive soiling of the peritoneum has taken place and where dry sponging would be out of the question. Instead, the cavity should be wiped out and packed with large quantities of gauze, this being placed between the coils of intestine. Many deaths are due to perforation in typhoid fever and the surgical side should be presented more emphatically to medical men, that more cases may be recognized early and saved. In connection with one of Dr. Mitchell's cases, Dr. Harte mentioned a personal case in which the patient died six weeks after perforation.

DR. JOHN B. DEAVER agreed with Dr. Harte regarding irrigation in infections of the peritoneum. In these cases the best rule is to get in quickly and get out quickly, doing as little as possible. The consensus of opinion now is that irrigation is not so good as was formerly supposed. Dr. Deaver believes that perforation and hæmorrhage in typhoid have as one of the causes cold bathing. When the patient walks to the tub his resistance is taxed; later, while in the water he is chilled, and it is reasonable to believe that hæmorrhage is thus induced. It is a good thing for country patients that tubs are not available. Dr. Muhlenberg of Reading formerly used the Bland method heroically and had many cases of hæmorrhage. Now he employs a let-alone policy and sees but little hæmorrhage. If this be true, why would there not be fewer perforations if too strenuous bathing was not employed?

DR. W. JOSEPH HEARN said that he does not wash out the peritoneal cavity at all in cases of peritonitis, but simply sponges. In but few cases is peritonitis general, and these patients die. The same rule applies here as in burns. If all the skin is destroyed the person dies, if only part is burned he may get well. So in cases of general peritonitis the subjects die. Dr. Hearn has recently operated on four cases of perforative appendicitis, the perforation being near the junction of the appendix with the cæcum. In all, the abdominal cavity was simply sponged out, and he is sure that three of the patients will get well and entertains hope regarding the fourth.

DR. WILLIAM L. RODMAN said that Dr. Mitchell's results

were better than the average and show the value of early diagnosis and prompt operation. In the main, Dr. Rodman is in accord with what had been said about irrigation. If gross soiling of the peritoneum be present he irrigates, as in the case of gunshot wounds of the intestine. As a rule in these cases, if operation is performed before intestinal paresis and soiling of the peritoneum have occurred, irrigation is not employed. Where visible soiling is present and fæces have passed out of the intestine, irrigation is perhaps best. It is remarkable how often one finds in these cases that no soiling has occurred. Murphy in 1890 demonstrated that soiling does not take place until the intestine is handled, and this observation stands good to-day. In one case of twenty-one perforations of the intestine by a rifle ball no extravasation had occurred, though two of the perforations were large. Operation was performed an hour after the injury. In another case a great amount of extravasation was present, this including an apple core which had passed into the peritoneum. As a rule, then, there is not much extravasation if cases of perforation are operated upon promptly; if there be gross soiling of the peritoneum, irrigation is demanded.

DR. GWILYM G. DAVIS has during the past year operated on eight patients with perforation and one in which the physician desired operation and no perforation was found. Six of the eight perforative cases died, though some lived quite a while after operation. Others were in extremely bad condition and lived but a short time. The non-perforative case also recovered. As to the mode of operation the transverse incision is employed and the operation begun under local anæsthesia. If perforation is found a general anæsthetic is then given. As to drainage and sponging, if the intestine is pulled out and soiling ceases, sponging is regarded as sufficient. If soiling be extensive, sponging requires too much time and causes too much shock. When fæces are spread all over the abdominal cavity, irrigation is employed. The operation requires from nine to twenty-five minutes. One must be governed by the condition of the patient. In some cases the work may be done with exactness, in others one must hurry. When perforation is not found, general anæsthesia is not necessary and the operation does not prejudice recovery. One of these patients had a second perforation some time after the first, for which an operation was done on the opposite side.

He recovered. Counting this as an additional case makes 9 cases with 3 recoveries besides the recovery from the exploratory procedure.

DR. MITCHELL, in closing, said that if he had employed local anæsthesia in one case he would not have found the perforation. When the abdomen was opened it was clear and no exudate was present; protracted search was necessary to locate the opening. In answer to a question of Dr. Rodman, Dr. Mitchell said that ten hours was the longest time between perforation and operation in the cases that ended in recovery.

CORRECTION.—In the Transactions of the Philadelphia Academy of Surgery, meeting of November 5, published in the February issue, on page 317, line 17, for the word “found” substitute “round,” so that it will read “ureteral calculi are rarely round.”

BOOK REVIEWS.

TUMORS, INNOCENT AND MALIGNANT. By J. BLAND-SUTTON, F.R.C.S., Surgeon to and Member of the Cancer Investigation Committee of the Middlesex Hospital, etc. Fourth edition. Chicago: W. T. Keener & Co., 1907.

The fourth edition of this work is in many ways an improvement upon the third edition, which appeared in 1903 and was reviewed at length in the ANNALS OF SURGERY. The author has changed his classification of tumors and from the four original groups has extended the number to six, as follows: I. Tumor-Diseases of the Connective Tissues; II. Tumor-Diseases of Teeth; III. Epithelial Tumors; IV. Tumors arising from the Foetal Membranes; V. Teratomata; VI. Cysts. In distinguishing between innocent and malignant tumors he defines them thus: "The baneful effects of innocent tumors depend entirely on the environment, but malignant tumors destroy life whatever their situation."

A most interesting chapter has been introduced concerning the cause of cancer. In this subject the author is especially well qualified to speak with authority, and he presents the three theories, the Embryonic, the Parasitic, and the Biologic theory impartially. His conclusion is that nothing is known as to the cause of cancer.

The chapter dealing with tumors of the ovary and testicle have been much improved. Two essays have been devoted to their consideration.

PAUL PILCHER.

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ORIGINAL MEMOIRS.

EXPERIENCES IN CEREBRAL SURGERY.*

BY FRANK HARTLEY, M.D.,

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AND

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THE most frequent causes of death following operations for tumor of the brain are shock and sepsis. "Shock is responsible for 8 per cent. of the deaths in the tumors correctly and accurately diagnosed and successfully removed. Whereas, in operations in which the tumors are inaccurately diagnosed, not found, and not removed, shock is responsible for 37 per cent. of the deaths" (Horsley, *British Med. Journal*, Aug. 23, 1906). In an approximative way this shows the importance of shock in operations upon the brain. Sepsis, like shock, is an important cause of death, but more especially as a secondary infection. Primary infection—that is, an infection at the time of operation—is rare, but it is the experience of most surgeons that just in proportion as one must drain and the healing is to be by granulation tissue, the danger of infection will increase.

* Read before the Association of the Alumni of Bellevue Hospital, February 8, 1907.

Nothing is more striking than the security against infection given by a primary union, and the absolute uncertainty existing in cases drained. To overcome these important factors we try to shorten the time of operation, to limit the hæmorrhage, and to avoid drainage in any form.

During some years of an operative experience in cerebral surgery we have noticed that many operations are performed with instruments often imperfect in themselves, or in the use of which the surgeon is frequently not familiar. We have also observed that after the definite localization of a tumor or cyst the craniocerebral topography is so imperfectly applied, and the flap so badly fashioned, that the tumor or the disease, if not extensive or prominent, is not found until autopsy reveals it. It has been our aim to shorten the time for operation by overcoming these undesirable facts. We have therefore tried, first, to find an armamentarium upon which we could thoroughly rely, which would serve as well no matter how thick or thin the skull, and which would permit an exposure of the dura in the shortest possible time and with the best possible relation of the bone and the flap to the skull after replacement. We have used in a number of instances the trephine, and from its opening have cut away the bone with the rongeur or have cut out a bone flap with some specially devised bone forceps, chisel or fraise. We have always been cognizant of the objections to their use, namely, the imperfect application of the bone flap to the skull when replaced, permitting the bone to rest upon the dura rather than upon the surrounding bone.

Second, when chisels are used the repeated blows have, in thick skulls, been productive of considerable shock. These objections are avoided by the Gigli saw, which cuts from within outwards, and with a very narrow slit, so that when the bone is replaced, if the bevel is ever so slight, it will rest upon the surrounding bone and not upon the dura. Its application requires several trephine holes, and the passage of a guard or director from hole to hole. When the dura is tightly attached to the bone or the intracranial pressure is great this is a tedious process. Unless the saws are of the best quality

they not infrequently break at the most inopportune moment. We have used also the Van Arsdale saw, a circular saw shaped like a saucer, and intended to cut on a curve, the dura being protected by a guard which follows in the slot, having been introduced through a trephine opening. The objection we have found to this saw was that the guard and the saw were very apt to jam and stick unless the particular arc for which the saw was designed was accurately followed. We have used also the Stellwagen trephine, a trephine having cutting teeth mounted on a movable arm which can be adjusted at any distance from the central fixed point. Larger or smaller osteoplastic flaps can thus be cut. The objection we have to this is that which we entertain against all trephines, including the large Horsley trephines, namely, that they do not cut the skull accurately and rapidly, nor allow of variation enough in their size to be of practical value in osteoplastic flaps.

We have used also Powell's saw in combination with the trephine. This has been quite satisfactory. The cutting depth is regulated by an adjustable shoe controlled by a screw. The screw, however, is apt to become loose and thus change the depth at which the saw will cut. We have used in the same way the Marsland saw, but see in it no advantage over other saws. The mechanism of the guard and the handle is good.

We have also used the Sudeck saw, but we consider it unsatisfactory, as it has no guard to regulate its depth in cutting nor are the handles so placed as to render it easily manipulated where a thick scalp is present.

We have used in addition the Doyen circular saw, and the method of using it has appealed to us more than any other saw. The mechanism is simple, and the individual parts are strong and do not get out of order.

From 1900 up to about a year ago many of the operations on the skull have been performed by us with the aid of burrs, drills, and circular saws, the power being furnished by a quarter horse-power motor through a flexible shaft which was made up of links, and was considerably heavier, stronger and more flexible, with less vibration and jar, than those made

of twisted wire. The entire shaft was sterilized by being disconnected from the motor, wrapped with a gauze bandage, and put in a bag or towel. The disadvantage of this apparatus was that, owing to its weight, it was not easily transported. The shaft, though flexible, had a certain fixed length which oftentimes, seriously interfered with the free manipulation of the cutting tool, and when bent at a slight angle, owing to the increased friction, gave a peculiar jar and vibration to the cutting tool. To overcome some of these objections, we make use of the following implements: *First*, a small motor, of such size and weight that it can be held by the operator himself, giving him perfect control of the cutting tool and also of the power (Plates I and II). The tools are connected by means of an appropriate chuck directly to the end of the armature, thus obviating all loss of power which occurs when a flexible shaft is used (Plate V, Figs. 1, 2, 6, 12).

To provide for the proper sterilization of the apparatus, a thin metal casing in three pieces is accurately and securely fastened to the motor, completely enclosing it, yet readily removable. This casing, with about 10 feet of ordinary flexible electric light wire is removed from the motor and boiled. The interior is dried with sterile gauze and then replaced on the motor, thus making a perfectly aseptic exterior. The method by which the sterile casing is applied to the motor is as follows. The motor is held with a sterile towel in the palm of the left hand, the end *A* being up. (See Plate II.) The portion *B* is now screwed down as far as possible and grasped by the right hand, which holds the motor, while the left hand being free, drops the towel, picks up the other portion *C* (which is still sterile inside and out) and slips it in place where it is securely held by screwing down the knob *D*.

During the operation the motor is held as follows: The adjustable handle *E*, placed at right angle to the long axis of the motor, furnishes a firm convenient grasp for the right hand. The knob *D* is grasped with the left hand. The left thumb or left index finger may be used to manipulate the switch which makes and breaks the current. Occasions may

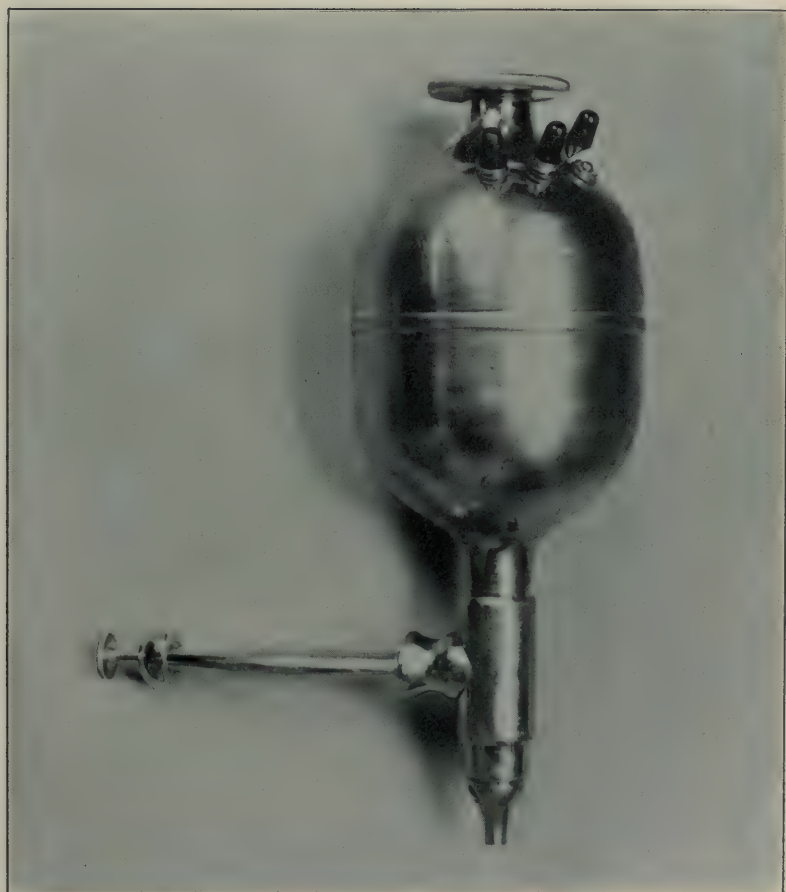


PLATE I.—Motor and casing complete. Weight, $8\frac{1}{2}$ pounds. One-eighth horse-power.

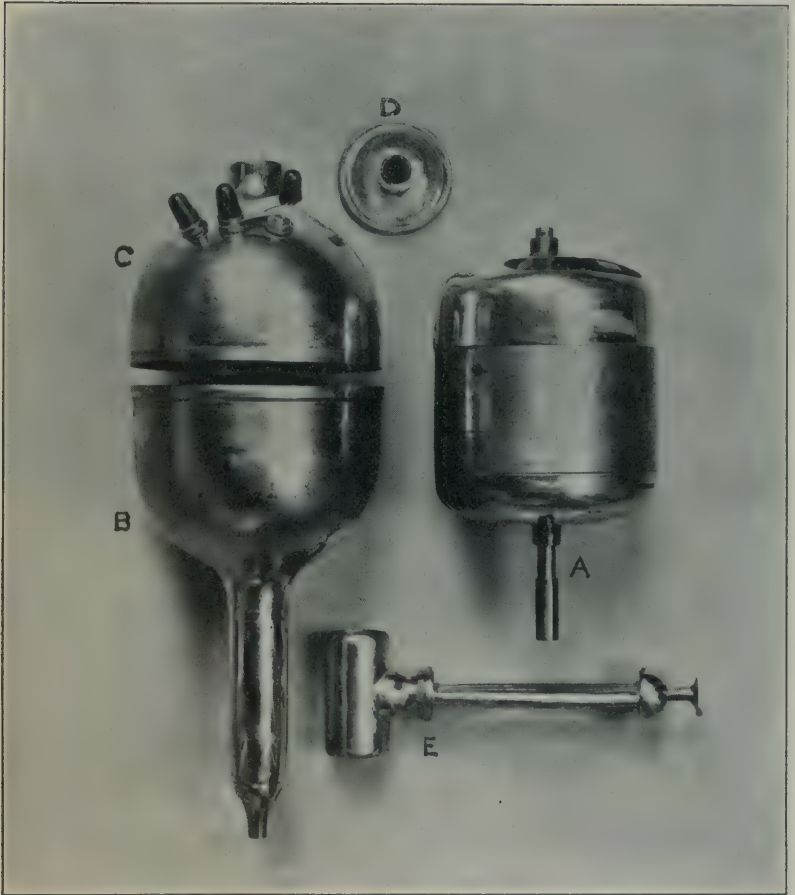


PLATE II.—Weight, with casing complete, $8\frac{1}{2}$ pounds. Weight, without casing, $6\frac{1}{4}$ pounds. Length, $10\frac{1}{2}$ inches. Diameter, $4\frac{1}{8}$ inches. Circumference, $14\frac{1}{4}$ inches. Speed, 2400 revolutions per minute. Volts, 115. A direct current; shunt wound. About $\frac{1}{8}$ horse-power.

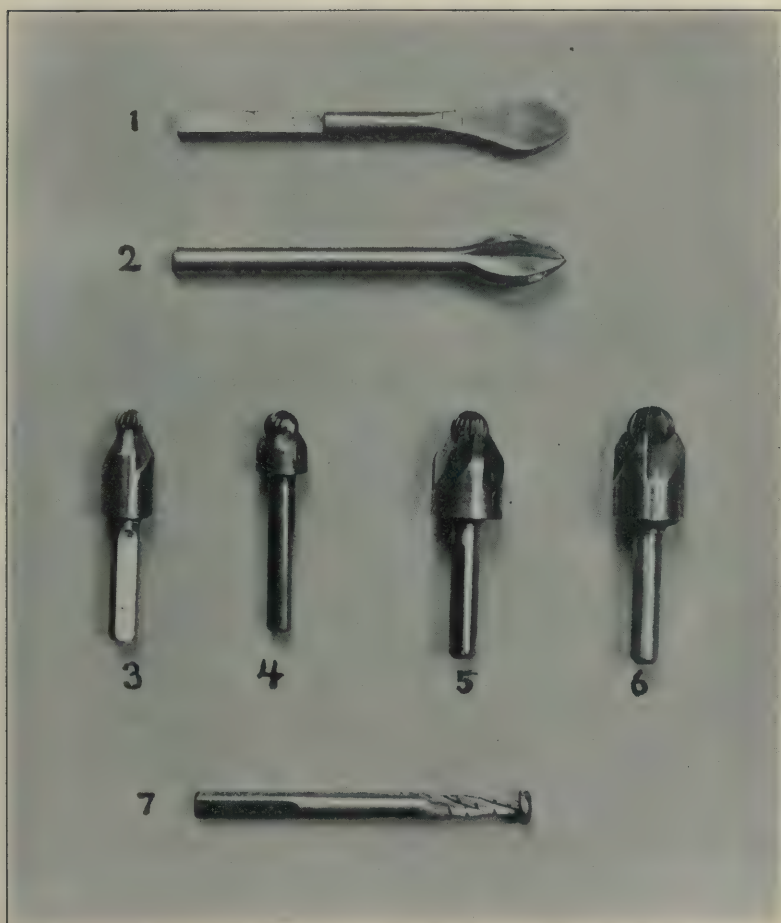


PLATE III.—1, 2, Conical cutters. 3, 4, 5, 6, Ball mounted in tip of cone. 7, Fraise. 1 followed by 3 is the usual combination.

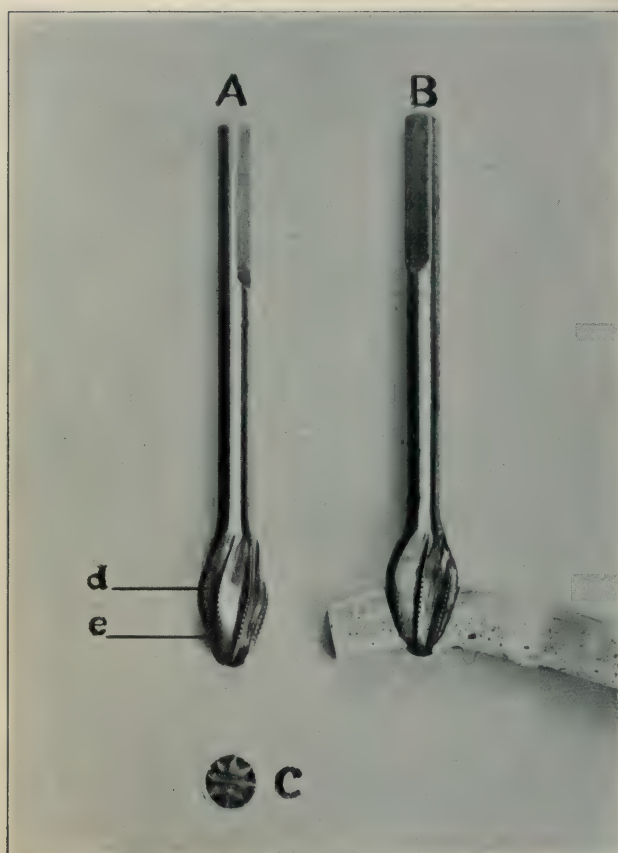


PLATE IV.—A single cutter combining the functions of 1 and 3, Plate III. *A*, *d*, greatest diameter of cutter, 10 mm. Distance from *d* to tip, 11 mm. Blades between *d* and *e* are serrated to facilitate cutting. Distance from *e* to tip 4 mm. *B*, manner in which cutter enters skull. *C*, end view of cutter.

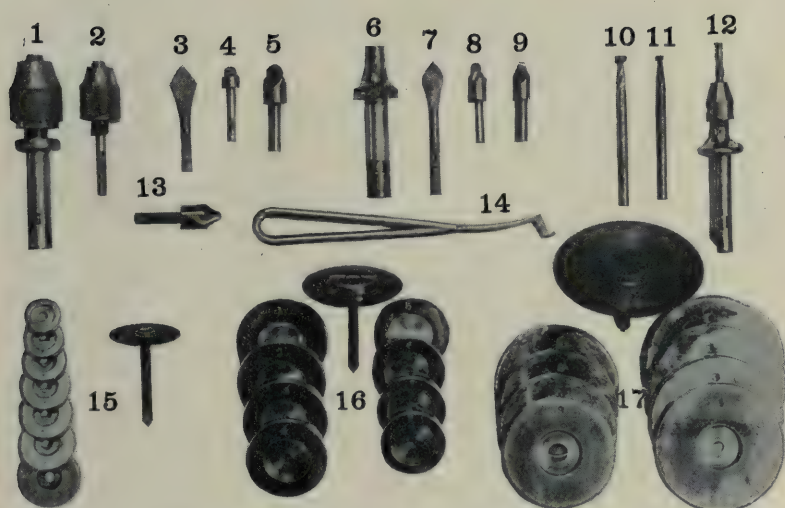


PLATE V.—1, 2, 6, Chucks. 3, 7, Conical cutters. 4, 5, 8, 9 Ball and cone cutters. 10, 11, 12, Fraises.
14, Measure. 15, 16, 17, Circular saws with guards.



PLATE VI.—Compressed-air motor fitted for using the same cutting tools as the electric motor. Weight, about six pounds. Requires 80 to 90 pounds air pressure. Motor and hose can be boiled.

arise when the position of the hands holding the motor will have to be reversed, but this can be easily done, and with the same degree of certainty of action in the instrument.

Secondly, a cutter has been devised after considerable experiment with all forms of drills and burrs which we could find. The shape of the cutter permits one to enter the cranial cavity without fear of suddenly pushing through the vitreous plate. The serrations upon the blades between *d* and *e* (Plate IV, Figures *A* and *B*) allow one to appreciate with the less rapidly cutting end, as with a probe, the difference in density of the outer plate, the diploe and the inner plate of the bone. One can appreciate this even by watching another person using the instrument.

Formerly we made use of two instruments instead of this single cutter,—the one a drill, the other a burr set in the end of a cone, which latter allowed the reaming of the cavity and at the same time prevented the burr from suddenly passing through and injuring the dura. We have of late been able to combine these two instruments in one, and feel that thereby we have shortened measurably the time in entering the the skull. This instrument is shown in Plate IV and the two separate instruments as devised by us and used formerly to a large extent are shown in Plate III, Figs. 1, 2, 3, 4, 5, 6, and Plate V, Figs. 3, 4, 5, 7, 8, 9, 13.

Thirdly, a circular saw. Upon this saw we make use of Doyen guards, each being stamped with the number of millimetres it will permit the saw to cut. We prefer this guard to others because it is strong; it is simple and it is easily sterilized. The saws vary in size from 1 to 3 inches in diameter; the larger saws being used when the tissues of the scalp are thick, and the narrower ones when the tissues of the scalp are thinner (Plate V, Figs. 15, 16, 17).

The other instruments which we make use of are those that are commonly used in all osteoplastic operations upon the skull, such as the retractors, the spud-like instruments for the elevation of the bone flap, the narrow, slender osteotome, periosteum elevator, and a millimetre measure for the depth

of the skull (Plate V, Fig. 14). Where an accurately fitting bone flap is not required or where the bone is to be removed completely and not replaced or where an opening in the skull is to be enlarged, a fraise may be used (Sudeck's, Cryer's, or Sykes'). If no opening exists, a hole is drilled of sufficient size to admit the button on the fraise. The fraise is inserted and forced to cut in the direction desired. We have modified the ordinary fraise by having cutting teeth or serrations upon the blades, and it seems to improve its efficiency to a marked extent. We object to the use of the fraise, however, except under the conditions above mentioned, because it cuts a wide slot which prevents an accurate fitting of the bone after its replacement. It cuts slowly, with considerable heating, especially where the bone is over 6 millimetres in thickness. (See Plate III, Fig. 7, and Plate V, Figs. 10, 11, 12.)

We have used in a few instances a motor run by compressed air, the same chuck and tools being used in the motor with compressed air as we have used in the electric motor. This whole apparatus, with the tubing, can be boiled. The motive power must be compressed air, at a pressure of 75 to 90 pounds, in order to have it efficient.

In the second place, we must determine upon a method of cranio-cerebral topography which is thoroughly reliable and practical. Contrary to the opinion expressed by many surgeons, I believe that cranio-cerebral topography deserves an extensive application in the surgery of the brain. The Chipault method, which I have used for eleven years and have tested upon over 200 cadavers, and in some 40 operations upon the living, is the most comprehensive and generally correct of all the systems. It adapts itself to all varieties of skull, no matter whether they be the result of race, age or individual peculiarity. The constant use of this system renders one quite adept in locating to a nicety the sulci and convolutions, and the various sinuses, without measurements; but this is not to be expected in everyone, and some trustworthy system must be at hand. (Chipault's "*Chirurgie Opératoire du Système Nerveux*," p. 121, vol. i.)



PLATE VII.—1. Motor and sensory disturbances, lower extremities. 2. Motor and sensory disturbances, upper extremities. 3. Motor and sensory disturbances, face, tongue, jaw, pharynx, vocal cords. Motor aphasia in right-handed people and vice versa. 4. I. Movements of the body (posterior part of the first frontal convolution). II. Movements of the head and neck (posterior part of second frontal convolution). III. Associated movements of the eyes and head. 5. Tactile and muscular sensibility. 6. Hemianopsia and word-blindness, agraphia and paraphasia. 7. Intelligence. 8. Storage of visual images (cuneus, lingual lobe and calcarine fissure cannot be seen). 9. Audition. 10. Images for words heard and musical tones (left side). In this same region on both sides, the sensory motor auditory centre exists. 11. Nasion. 12. Inion. 13. Retro-orbital tubercle.

The internal frontal convolution lies in the longitudinal fissure, opposite the superior frontal convolution. The para central convolution lies in the longitudinal fissure opposite the ascending frontal, between the 45% and 55% points. The quadrate lobe lies in the longitudinal fissure opposite the ascending and inferior parietal convolutions, between the Rolandic and Sylvian lines, that is, the 55% and 70% points. The cuneus, lingual and the fusiform lobes, first, second and third occipital convolutions are between the 70% and 95% lines.

Plate VII is made from a specimen most carefully prepared by Drs. Ayer and Spitzka. The subject used was injected immediately after death with a strong solution of formalin under slight pressure. The Chipault measurements were then made upon the skull and the bone between the lines was removed, leaving the thin and narrow strips of bone to represent these lines. The skull was now bisected antero-posteriorly and the hardened brain was removed entire. From this brain a cast has been carefully prepared, and upon this cast has been painted the various points of localization as we use them. The cast has been substituted for the brain in the skull, and this drawing has been made from it. One can see from this drawing that, given any point of localization of value, a sufficiently large flap can be made which will have beneath its centre, or to one side of its centre if desired, the area in the brain to be exposed. Flaps accurately placed are of great advantage because one removal of bone is sufficient for the exposure of all possible eventualities. For the neurologist and for the surgeon such a flap permits a rapid and accurate orientation of the area to which the motor, sensory or sensorial symptoms have referred. For the patient it shortens the time of operation, it diminishes the hæmorrhage, and it avoids undue shock.

The great advantage of an accurate knowledge derived from this source can only be appreciated when searching for subcortical tumors or in dissecting out traumatic cysts with their irregular diverticula and their adhesions to the surrounding brain tissues.

It is our custom, therefore, to measure every scalp before it is cleaned for operation. The measurements are written down and at the time of the operation the lines are drawn with a fuchsin pencil or with tincture of iodine. After consultation with the neurologist the possibilities of the case are considered, and the flap is fashioned so as to best expose the area desired. After the bone flap is thus fashioned and the dural flap is made, the lines will show at a glance the fissures and convolutions desired. At any time the flap may be replaced,

and the position of the line upon the brain measured with the eye. If the disease or tumor can be located, the centre of the flap is usually over the point of localization. If the localization cannot be exactly determined, the operation becomes more or less exploratory, and the flap is cut so as to expose centre of the parietal or both sides of occipital or frontal or cerebellar lobes.

Thirdly, we are convinced, after quite an experience in cutting cranial bone flaps, that the best form of flap is one which obtains its blood supply from the temporal or occipital arteries. The supra-orbital and frontal arteries may be used, but they are not necessary.

Fourthly, the variations in the depth and density of the bones of the skull have shown us that the safest and quickest means of dividing the bones is to select the thinner portions as bases for the periosteal-flaps, and to divide the thicker and denser portions with a saw. The variations in depth of the bones range between 1 mm. and 12 mm. in the adult. We have measured one or two skulls in which the temporal fossa has measured $\frac{1}{2}$ mm. in depth. Some skulls have measured 12 mm. to $12\frac{1}{2}$ mm. in the thickest portions, near the sagittal suture or in the occipital bone. We expect usually to find in the temporal fossa the thickness ranging from 2 mm. to 5 mm. Half way between the temporal fossa and the sagittal suture the usual variation in depth has been 5 mm. to 7 or 8 mm., while from this point to the median line the depth usually ranges from 7 or 8 mm. to 11 or 12 mm. This variation in measurements holds good for all parts of the skull from the frontal bosses to the superior curved line of the occipital bone. So that, if a line be drawn 1 cm. laterally to the sagittal suture from the frontal bosses to the superior curved line of the occipital bone, the varying depth will be from 7 to 11 mm. If a line be drawn half way between this line and the ridge bounding the temporal fossa from the frontal bosses to the superior curved line of the occipital bone, the usual depth of the skull will range between 4 or 5 and 6 and 8 mm. In the temporal fossa itself the variations will be from 1 to 4 or 5 mm.

From these measurements one can conclude that the thinnest part of the skull is in the temporal fossa, and that from the edge of this fossa the bone increases in thickness and density as it approaches the frontal bosses, the sagittal suture and the superior curved line of the occipital bone. Unfortunately, this increase in thickness and density is not always regular nor gradual, so that in the preparation for the saw one must drill enough holes to avoid a decided variation in depth. We have found that if the drill holes are within 4 cm. of one another one is reasonably certain of avoiding any great disparity. If such is observed, a third hole may be drilled between the two holes showing such disparity. The danger arising from this disparity in depth can be eliminated in this manner. Because the temporal fossa is thinner than the remainder of the convexity of the skull, all our bone flaps exposing the frontal, the parietal and the occipital regions of the brain are best and most easily made when the base of the flap is in the temporal fossa. This being the thinnest part of the skull, the breaking of the bone can be accurately determined and made without the great force necessary to break it in a thicker portion, and the uncertainty which exists of having the bone flap break in the middle and not at the desired point. This may occur, no matter how much care is used when a very thick bone is used for the base of the flap. All our flaps then radiate from the temporal fossa as a base. Frontal flaps have their bases in the anterior part of this fossa, parietal flaps in the middle of this fossa, and occipital flaps in the posterior part of this fossa.

Fifthly, after a flap is fashioned and the bone is removed, it may be replaced. The defect may be filled with bone from another individual, animal, or with a foreign substance. We prefer, in all cases, to replace the bone or to implant a foreign substance because this affords protection to the brain, it prevents hernia cerebri, it limits adhesions between the dura mater and the pia mater and the brain, and it secures the most rapid and perfect healing.

Of these methods, we prefer the autoplasmic to the homo-

hetero- or necro-plastic; we prefer the necro-plastic to the homo- or hetero-plastic.

Autoplasty is performed by the implantation of bone having a partial connection with the surrounding parts (Wolff: *Langenbeck's Archives*, No. 4, p. 183, 1863; Wagner: *Centralblatt für Chirurgie*, No. 47, 1889) or by the implantation of bone completely separated from all connection with the surrounding parts (von Walther: *Langenbeck's Archives*, No. 4, p. 196).

The former method is preferred: First, because bone which is entirely separated from the periosteum and implanted usually undergoes absorption and a gradual substitution by new bone, and this substitution does not always take the shape and form of the displaced bone. Second, because such implanted bone larger than 8 cm. x 5 cm. has, as a rule, undergone necrosis. Third, because bone which remains in connection with the periosteum and implanted undergoes an immediate reparation wherever the circulation has been in no wise disturbed. This condition is best obtained where the continuity of the bone has been the least disturbed, and subsequent apposition of the bone flap and skull is the most intimate. (Stieda: *Archiv. für klin. Chir.*, No. 77; Biagi: *Deutsche Zeitschrift für Chir.*, No. 65.)

The most successful autoplasmic result therefore occurs when the bone edges are cleanly cut, are cut with a very narrow slit, and are slightly bevelled. This will bring the replaced bone in perfect apposition with the surrounding skull and dura, and will avoid any pressure upon the brain by reason of the bevelled edges.

Sixthly, For the general result hæmorrhage is a most important element. It should be quickly controlled in order that time may be saved.

Our method of operating is as follows:

A preparatory treatment of one week, if possible, is desired. During this period drugs are given up as far as possible, the bowels are regulated, and the skin and kidneys are put in good condition. If it is possible, a sphygmographic

record of the pulse rate and blood pressure is made during this time. The head is completely shaven, and the measurements for the Chipault cranio-cerebral topography are made and recorded. The skin is then prepared for operation in the usual way. Chloroform is the anæsthetic preferred. The position of the patient upon the table is important. We prefer to have the body inclined at an angle of from 10 to 30°, with the head upward and beyond the end of the table, resting in our special head-support, which permits of a further change of the head without difficulty. At the side of the table an assistant applies to the wrist some form of blood-pressure apparatus, and records during the operation the pulse rate and the degree of blood pressure. The operator and the anæsthetist can, by watching the needle, record the blood pressure, and best inform themselves of an impending shock. The operator can decide in this manner the necessity of a two-stage operation. He can thus avoid some of the 25 per cent. of sudden deaths which follow operations upon the brain. (*American Journal of Medical Sciences*, 1904, p. 320.)

A tourniquet is applied surrounding the head, just above the ears. This may consist of an inflatable rubber tubing or be a simple rubber tubing tied or held by a fastening. If the tourniquet is not used, a large number of compression forceps are at hand and, as each limb of the incision is cut, an assistant compresses this side until the vessels are clamped and tied. Instead of ligatures a buttonhole stitch may be applied over the cut edges of the skin, aponeurosis, muscle and peritoneum. If one desires, the clamps applied to the vessels may be left without tying until the conclusion of the operation. A recent important addition to this subject has been the application of Kredel's steel plates (*Centralblatt für Chirurgie*, No. 43, 1906). So far we have not had an opportunity to make use of them, but they appeal to us as very simple and practical. Our incisions expose a ∇ shaped flap. Each limb or third of the incision is made with a single stroke of the knife to the bone, in order that the vessels be readily exposed for ligation. A hoe-shaped periosteum elevator is now used and the perios-

teum is raised beneath the flap for a distance of 1 cm. upon all sides. The periosteum surrounding the flap is also pushed back for 2 cm. This gives, when the retraction is complete, a broad area for the cutter and saw. By raising the periosteum beneath the flap for 1 cm. and applying the cutter and saw near the reflected margin of the periosteum an excess of periosteal-musculo-cutaneous flap is obtained, and the subsequent suture line of the flaps does not coincide with the incision in the bone. (Curtis.) Our retractors are now inserted and the field is prepared for the cutter. This is applied to the bone at each corner of the flap, and the dura is exposed. The depth of the several holes is ascertained by the measure. Whenever the disparity between two holes is over 2 mm., that is, 3 or 4 mm., it is best to interpose one or more holes, and ascertain whether it is an abrupt or gradual incline. In this manner one can tell whether he should saw straight through, should bevel or should change the guard upon the saw. This makes the procedure safe, and it does not delay the operation to any extent. As the depth of the holes varies, it is our practice to saw the deeper parts at first with a saw guarded for 2 mm. less than the depth. This saw passes straight through between holes having the same depth. When the holes having a smaller depth are approached, one must either change the guard or diminish the depth by bevelling. If such disparity exists between two holes, we saw at first straight through and then gradually incline the saw so that a ledge is left upon the skull which supports the bone flap. We find that to slant the saw sufficiently to eliminate a difference of 2 mm. in depth is about all that we can do nicely and with certainty. When greater disparity in depth exists, the angle formed by the saw and the skull will be 45° , and this is not very easily maintained. A disparity of 1 to 2 mm., however, is overcome by slanting the saw from 10° to 30° , which can be done with accuracy and ease. If one prefers, one can change the guards more frequently, but it is scarcely necessary except for marked irregularities, for depressions from Pacchionian bodies or when passing over sinuses. In some parts of the skull, as the

temporal fossa near the zygoma or the cerebellar fossa, where the muscular tissue is very thick, or wherever we intend to sacrifice bone, we may substitute for the saw our toothed fraise which, though it cuts a rather broad slit, nevertheless answers the purpose admirably.

An osteotome is now inserted in the slit, and a few strokes of the hammer, unless the bone is very thick and has been imperfectly sawn, will crack the vitreous plate. The plate is now raised and broken at its base with a spud-like instrument. The base will break evenly across provided the two holes at each extremity of the bone have clearly divided the internal table. I have never seen the slightest injury result when the holes have perforated the internal table, provided the base is less than one-half of the greatest width of the flap and is not thicker than 4 mm. At this time hæmorrhage from the bone will require some attention. We use for this purpose either a crushing forceps upon the bleeding sinus in the bone, or plug it with decalcified bone, cut in the shape of a match, or with Horsley's wax. The flap, including the bone, periosteum, muscle and skin having been reflected and wrapped in a sterile towel to protect it from injury or infection, the dura is exposed and its pulsation or want of pulsation is noted. If wanting, we suspect the cause to be either adhesions between the dura and the arachnoid, exudates, pus or blood between the membranes, severe contusion of the brain or tumors near the cortex producing anæmia of the overlying brain.

We must determine, if possible, which of these conditions is probable, and then proceed to the formation of our dural flap. This flap we usually incise along three margins of the bone, leaving enough for a subsequent suture when the dural flap is replaced. Usually the uncut side is the one which has the larger vessels. With the retraction of this flap the brain is exposed. At this time, the pressure being relieved, there may be a marked fall of blood pressure, as shown by the sphygmographic tracing. If this is the case, the operation may be postponed, after replacing the bone flap, for two to seven days, or until a time when the circulatory equilibrium is restored.

If we are to proceed with the operation, the procedures for the removal of the disease or the tumor will vary necessarily according to the kind and extent of the pathological process. (See individual cases.) After the disease or the tumor is found and removed, hæmorrhage is carefully checked. And we find it best in all cases to tie the arteries with catgut, to use hot water at 115° or gauze held in contact with the bleeding surface, when the hæmorrhage is capillary. When it is venous we apply sutures where the sinuses are involved, and where it is simply a venous oozing we reduce the chloroform and administer oxygen, as suggested by Horsley (*loc. cit.*). We have also found that the application of Cargile membrane to the raw surface of the brain tends to check the slight oozing remaining after the larger vessels have ceased bleeding. The hæmorrhage being carefully controlled, the dura is sutured and the bone is replaced. The drill holes, where the operation is an aseptic one, are sufficient for drainage, but when this is not the case, or drainage must be extensive, these openings may be enlarged by cutting away the bone opposite the bone flap. The bone flap when replaced fits accurately and cannot be driven in even when forcibly pressed upon. The periosteum and muscle are sutured by a single suture. Our drainage when used is the cigarette drain. The skin is sutured over them, and an aseptic dressing is applied. The head is fixed and is held slightly elevated above the level of the body.

This is our technique in autoplasic operations upon the skull, and we employ it in every instance. Our flaps must be so planned as to expose the several lobes of the cerebrum as well as of the cerebellum, on one or both sides, and consequently we will so describe them.

Frontal Lobes.—Disease or tumor involving the frontal lobes, as well as tumors of the hypophysis, demand an exposure of both sides at once, unless the symptoms point distinctly to one side. The exposure should be sufficient in all instances to give access to the upper, lower and lateral surfaces of the lobe in any case, no matter whether one or both sides are to be exposed. Again, if motor symptoms are combined with

symptoms of purely frontal involvement, the exposure must include the ascending frontal and possibly the ascending parietal convolutions. If the symptoms localize the disease to one side, the incision necessary to expose the three frontal convolutions upon their anterior and lateral aspects must include the area bounded by the depression between the frontal bosses and the superciliary ridge, the prærolandic line and the median line. The base of this flap and the line of breakage in the bone we make in the temporal fossa above the zygoma, where the bone is the thinnest. Our incision commences one finger's breadth from the median line, usually midway between the glabella and the superciliary ridge. It passes outward parallel to this ridge until the temporal ridge is met, where it descends towards the zygoma, ending just above it. The second incision passes from the commencement of the first, parallel to the interfrontal and sagittal sutures, as far as the prærolandic or Rolandic line, depending on the extent of the localizing motor symptoms. The third incision passes from the termination of the second toward the external meatus, ending just above the lobe of the ear. The flap is larger or smaller, depending upon the extent of the motor symptoms combined with the psυχical.

This, to be sure, brings an incision directly across the forehead above the orbit, but I believe it is better to have this scar than to attempt to avoid the scar and risk breaking into the frontal sinuses, thus complicating the wound treatment. If one wishes to avoid the scar the line of breakage may be made at the upper level of the frontal sinuses. In this case, the supra-orbital and frontal arteries will supply the flap. We prefer, however, to have the line of breakage in the thin squamous portion of the temporal bone, and to have our arterial supply from the temporal arteries. After these incisions are made to the bone, the hæmorrhage is controlled. Retractors are inserted at the angles of the wound, and the cutters are used. One hole is made at each extremity of the second incision, one at the temporal ridge, one at each extremity of the first and third incisions where the line of breakage

is to take place. We usually content ourselves with these five openings unless the distance between them is greater than 3 to 4 cm., or the disparity in the depth of the skull is more than 3 or 4 cm. In the latter case we prefer to drill one or more holes to ascertain the depth and to know where to saw straight through, and where to bevel or to use a smaller saw. As soon as the sawing is completed the bone flap is raised and broken in the squamous portion of the temporal bone. There are usually one or two veins from the longitudinal sinuses and the sphenoparietal sinus which bleed, but these can be easily and quickly secured as soon as the bone flap is raised. In some instances the frontal sinus is opened, but one can be reasonably sure of avoiding it by making the incision nearer the glabella than the superciliary ridge. Sometimes when the bony wall of the sinus is exposed its muco-periosteal lining remains intact. Even if it be opened, it can be drained and packed by cutting away a part of the anterior wall. (Duret: "Les Tumeurs de l'Encéphale.")

During the formation of the periosteo-osseous flap, the time consumed and the failure to stop hæmorrhage may result in a marked diminution of the blood pressure, and presage an impending collapse. To avoid such a result, the operation should be terminated, the wound packed, and the patient placed in bed and treated symptomatically. Within seven to fourteen days the operation is resumed and completed. When resumed, the bone flap is reflected, and palpation of the dura mater determines the degree of intracranial pressure, as well as the difference in the consistency of the underlying tissues. This can be rendered more appreciable by raising the patient's head and diminishing the intracranial blood pressure and tension in the dura, as suggested by von Bergmann. Observation again gives the changes in the color and often the location of the diseased area from the want of pulsation in the dura. The dural flap is now incised upon three sides of the quadrilateral area exposed by the bone flap, selecting for the base of this flap the most vascular part. If the frontal sinus has been opened, we make the base of this dural flap at this side

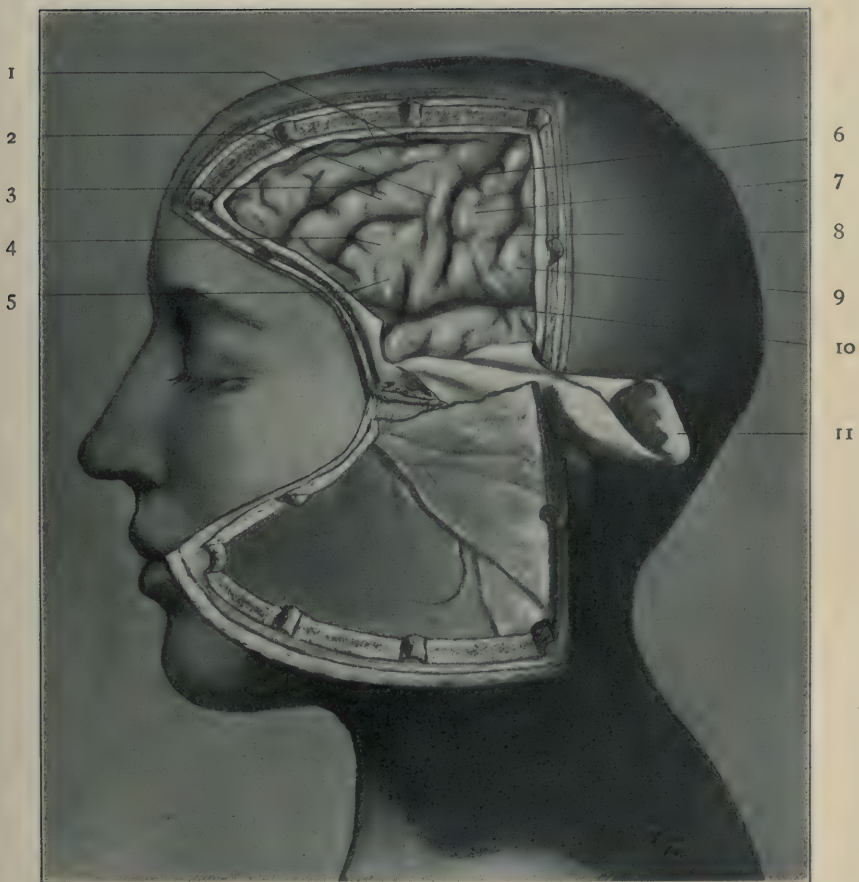


PLATE VIII.—1. Superior frontal convolution. 2, 3. Middle frontal convolution. 4. Inferior frontal convolution. 5. Points to vertical limb of the Sylvian fissure. 6. Points to the præcentral sulcus. 7. Points to the ascending frontal convolution. 8. The fissure of Rolando. 9. The ascending parietal convolution. 10. Fissure of Sylvius (the first temporo-sphenoidal convolution is shown just below the fissure). 11. The dural flap.

of the quadrilateral space. This flap exposes the three frontal convolutions, superiorly and laterally. It exposes in front the ascending frontal convolution, the Rolandic operculum, the Sylvian fissure, and the first temporo-sphenoidal convolution as far as the parietal operculum. If the incision is made just behind and parallel to the præcentral sulcus instead of just behind and parallel to the Rolandic, then the Rolandic operculum and the fissure of Rolando mark the posterior boundary of the exposed area. By retracting outward the internal surface of the frontal lobe may be seen. By raising the frontal lobe the inferior surface may be palpated and seen. Von Bergmann removed an angiosarcoma successfully in much this same manner.

This is a good type of exposure (Plate VIII), and is the one to be preferred where the lesion is one-sided, in the frontal lobe, encroaching upon the sensory motor area. This will include tumors or disease involving the anterior part of the first, second and third frontal convolutions, tumors of the frontal lobe encroaching upon the posterior part of the first and second convolutions or ascending frontal convolution in which, to the frontal symptoms, are added gradually, motor disturbances involving the trunk, the head, neck and eyes or speech. Tumors of the white substance, with marked psychical disturbances and later intermittent motor symptoms, are also accessible. By raising the frontal lobe, one can obtain a view of any tumor present upon the inferior surface of this lobe. These tumors have been described by von Bruns, by Dupré and Devaux. By retracting outward the frontal lobe, the median surface can be partially exposed, and the first frontal convolution upon the median surface can be seen. Tumors situated in this frontal convolution, and especially in its anterior half, have been quite easily removed, and we may cite here a case of Labbé (*Société Anat.*, 1896, p. 762).

In this region of the brain I have had 15 cases. Of these cases, only 7 are available, since we do not wish to include any cases unless we have heard from them at several long intervals following their operation, or, in case of death, have

obtained an autopsy. The operative recovery of a case has but little significance unless functional restoration accompanies it.

CASE I.—B. C., March 6, 1891, Roosevelt Hospital. Discharged April 13, 1891. Male, twenty-four years of age. *General symptoms*: Vertigo; mental torpor, almost unconscious periods; intense headache. *Localizing symptoms*: Paresis of right arm; motor aphasia; agraphia. *Diagnosis and location*: Compound fracture, subdural cyst or adhesions. Ascending frontal and posterior part of third frontal. *Operation*: Trephine; removal of bone with rongeur forceps; replacement of flaps without bone. *Result*: No cyst; adhesions found binding pia, dura and brain substance. Removal. Improved greatly; died in 1893 without a return of symptoms. Could walk and write well; no aphasia.

CASE II.—M. A. N., March 11, 1892; discharged April 29, 1892. Male, thirty-two. *General symptoms*: Double optic neuritis. Vision lost in right eye five years ago. Injury to skull twelve years ago. Gradually increasing frontal headache and mental apathy. *Localizing symptoms*: Convulsive movements in right arm, head and neck. Distinct aura of nausea preceding each attack. During all attacks all sounds are exaggerated. No loss of consciousness. *Diagnosis and location*: Cerebral traumatic cyst, posterior part of the second frontal and ascending convolutions. *Operation*: Large trephine and rongeur forceps over the fronto-parietal region. Dura incised, nothing found. Second trephine over the external angular process of frontal bone—dura incised, nothing found. *Result*: Not improved. Fifteen months later patient died, and autopsy showed a traumatic cyst, situated over the posterior part of the second frontal, ascending frontal and parietal convolutions. This cyst communicated with the lateral ventricle.

CASE III.—S. I., May 16, 1893. Roosevelt Hospital. Discharged June 27, 1893. Male, fourteen. *General symptoms*: Headache, gradually increasing after injury three years ago. *Localizing symptoms*: Convulsive movements in face, neck and arms. No loss of consciousness. *Diagnosis and localization*: Traumatic cyst or adhesions, the result of the compound fracture over the frontal and parietal lobes. *Operation*: Horseshoe flap trephine to the side of the $\frac{3}{4}$ -inch cicatrix between dura and

scalp. Removal of cicatrix and exposure of the pia mater. Traumatic cyst found, containing 2 drachms of fluid. Removed entire. Flap replaced. *Result*: Patient improved. No attacks for sixteen months. Lost sight of until May 3, 1900. No return of symptoms at that time.

The first of these three cases is interesting in that without more than a removal of the adhesions and a perfect wound healing a perfect functional result took place. The second and third cases are of interest in that in one the cyst was not found and the patient ultimately died, probably as a result of it. While in the other the finding and removal of the cyst resulted in both an operative and functional recovery. In both traumatic cysts the injury and the gradual progression of the headache, the repeated attacks of convulsive movements, the trouble of vision, and the mental apathy, pointed strongly to the diagnosis and location.

CASE IV.—Mrs. F., admitted July 13, 1894, Roosevelt Hospital. Discharged August 27, 1894. Female, forty-six. *General symptoms*: Headache, more in frontal region than elsewhere. No other general symptoms than mental apathy. Injury to frontal region ten years ago. Symptoms present five years. *Localizing symptoms*: Frontal headache, local tenderness to percussion over a swelling $3\frac{3}{4}$ cm. in diameter in lower half of left frontal bone. *Diagnosis and localization*: Intracranial dermoid, cholesteatoma or a sarcoma of the frontal bone over the second and third frontal convolutions. *Operation*: Omega-shaped flap including the periosteum. Bone removed by the rongeur forceps. Removal of cyst and contents entire. *Result*: Patient made a complete recovery. Was seen in 1900, February 1, and was then in perfect health. *Diagnosis*: Cholesteatoma.

This case, which has been reported as an intracranial implantation dermoid (ANNALS OF SURGERY, Feb. 26, 1896), showed the characteristic appearances of a cholesteatoma (Ewing). The relation of trauma and the tumor render such a diagnosis very probable. (*Deutsche Zeitschrift für Chir.*, p. 361, vol. lxx.) This condition is rare, existing three times in

10,000 autopsies (Benda). It is very difficult to distinguish from traumatic cysts, since the relation of trauma and the slow progression of the symptoms are the same in both. In order to obtain a cure a very complete extirpation of the capsule must be made, for, although they are not malignant, they will recur.

CASE V.—Admitted September 12, 1906. Discharged September 15, 1906. Hudson Street Hospital (Dr. Connor). Male, forty. *General symptoms*: No previous history. Unconscious; general convulsions (thirteen in twenty-four hours); stertor; pulse 100; temperature 102°; respiration 24. Reflexes exaggerated. Spinal fluid. No meningococcus. Blood examination, 50,000 leucocytes, 93 per cent. polynuclear cells. Urine negative. *Localizing symptoms*: None. *Diagnosis and localization*: Possible abscess of the brain. *Operation*: None. *Result*: Died without regaining consciousness and with symptoms of hypertension of brain and infection. Temperature ranged between 103°–108°; pulse, 100–152; respiration, 24–48.

Autopsy: Autopsy shows that the organs other than the brain are in good condition. In the brain is situated a hydatid cyst, with a firm but non-adherent capsule occupying the internal and anterior portion of the first frontal and the greater part of the second frontal convolutions. It extends backward to the ascending frontal convolution, but does not displace it, nor does it displace the third frontal convolution. It compresses the posterior part of the first and second convolutions more in the depth than appears superficially. The tumor displaces, but does not invade these convolutions (Dr. Elser, pathologist New York Hospital). The position of the cyst is such as would give no localizing symptoms other than frontal headache, mental apathy, inaptitude for work, and mental inattention. Apparently this was the case until the symptoms of hypertension, unconsciousness and generalized convulsions took place. At this time he was admitted to the hospital, with the meagre history of his headache and gradually increasing torpor. Such cases are mentioned (Estaves and Herrega Vegas, *Chippault Chir. Nerv.*, 1903, p. 881). In this particular case our frontal flap would have exposed it, and not being adherent, it could have been removed easily with its fibrous capsule. See Plate IX.

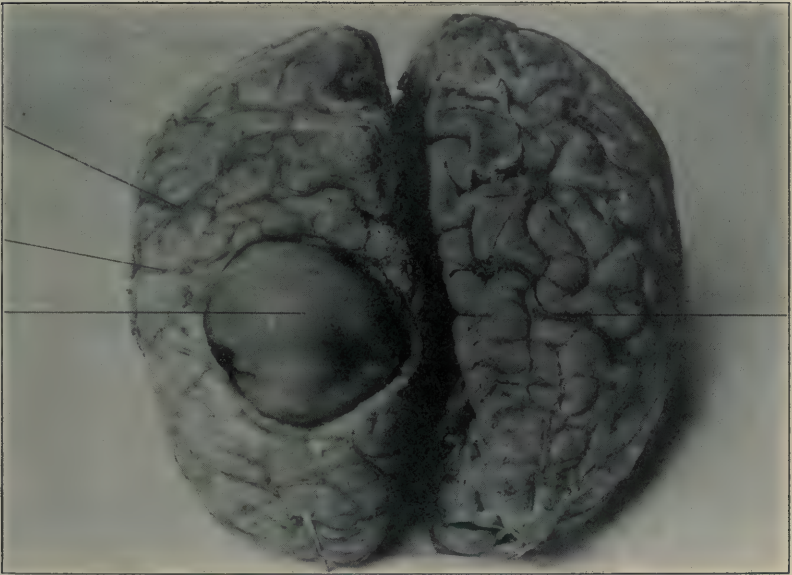


PLATE IX.—Case V. Hydatid cyst. 1. Fissure of Rolando. 2. Præcentral fissure. 3. Cyst.
4. Præcentral fissure.

CASE VI.—New York Hospital. March 22, 1906—March 26, 1906. Male, twenty-seven. *General symptoms*: Old injury to head. No fracture. Three months severe headache. Patient found unconscious in street with convulsion of left side (face, neck and arm). Convulsions during next three days became general. Double choked discs. Babinsky present. Increasing stupor. *Localizing symptoms*: Intense frontal headache, convulsions limited to face and arm—none of the muscles of the head, neck or eyes. *Diagnosis and localization*: Condition at first thought to be due to nephritic poison, later diagnosis of sarcoma or glioma of the face and arm centre in the prærolandic area. *Operation*: None. *Result*: Died.

Autopsy.—The skull cap is unusually thick and heavy. Dura: the external surface is normal. Tension is increased and more marked on the right than on the left side.

The superior longitudinal sinus is normal. The dura is adherent to the pia at one spot over the right frontal lobe; otherwise the internal surface is normal.

Leptomeninges are markedly congested. At one point corresponding to the situation of the tumor described below, the pia is slightly thickened and adherent to dura. The convolutions are flattened and that portion of the right hemisphere situated in front of the præcentral fissure is enlarged and somewhat distorted. The internal surface of this portion of the right hemisphere bulges distinctly, causing a corresponding depression on the inner surface of the opposite hemisphere.

An irregularly spherical tumor, measuring $6 \times 5 \times 4\frac{3}{4}$ cm., is found in the substance of the right frontal lobe situated immediately beneath the pia, to which it is attached over an area the size of a half dollar. From this point the tumor projects downward into an excavation in the substance of the frontal lobe. This cavity has the general shape of the tumor and measures $8 \times 6 \times 6$ cm. The space intervening between the tumor and surrounding brain substance is filled with a clear serous fluid. This cavity extends backward to a point on a level with the præcentral fissure, but does not encroach upon the anterior central convolution. Downward it extends to within a few mm. of the anterior horn of the lateral ventricle; outward and forward to within 2 to $2\frac{1}{2}$ cm. from the surface of brain, and inward to within 1 cm. of the mesial aspect of the hemisphere. The internal surface of the

cavity is smooth and traversed by a fine network of injected blood vessels.

The tumor is covered by a distinct capsule, and presents on its surface a meshwork of large injected blood vessels. Its consistence is moderately firm. The cut section is smooth, somewhat mottled in appearance, very vascular, reddish areas alternating with irregular grayish-yellow translucent hyaline areas. The brain substance itself is œdematous. The basilar vessels and basal venous sinuses are all normal.

Microscopic examination of this tumor shows it to be an angio-endothelioma. Dr. Elser, pathologist, New York Hospital.

CASE VII.—New York Hospital. April 10, 1906—April 17, 1906. Male, ten. *General symptoms*: Three weeks ago injury to right side of head. Four days later severe headache and nose-bleed, and some twitching of left hand on admission. Marked headache. Complete paralysis of left arm, weakness of left leg. No sensory disturbances. Knee jerk absent. No ankle clonus. Epigastric and cremasteric reflexes diminished, left side. Contusion of scalp over right parietal bone. No ecchymosis. *Blood examination*: leucocytes 12,600 to 8,600; polymorphonuclears 83 per cent. to 74 per cent.; temperature 99.8 to 100.2; respiration 76 to 46. *Localizing symptoms*: Marked headache. Evidence of injury. Paralysis of arm and weakness of leg. *Diagnosis and localization*: Encephalitis, subcortical; Rolandic area, upper and middle thirds. *Operation*: Consent not given. *Result*: Death with increasing stupor.

Autopsy.—The organs other than the brain are normal. Brain: the anterior two-thirds of the right hemisphere is enlarged, swollen and œdematous; the convolutions are flattened. At a point in the posterior part of the right superior frontal convolution is a small irregular perforation which communicates with an abscess cavity, situated in the subcortical white substance, beneath the posterior half of the first and second frontal convolutions. This cavity is filled with a thick creamy pus and measures 2 inches in its transverse and $1\frac{1}{2}$ inches in its vertical diameter. The outer margin of the pyogenic membrane lining the cavity is fairly well defined. The abscess is situated just anterior to the Rolandic fissure, with the exception of the subcortical projection fibres of the arm centres. It does not encroach upon the basal ganglia.



PLATE X.—Case VI. Angio-endothelioma. 1. Tumor. 2. Second frontal convolution. 3. Incision into brain, exposing the lateral aspect of the tumor. 4. Third frontal convolution. 5. Sylvian fissure. 6. Rolandic fissure. 7. Præcentral fissure.

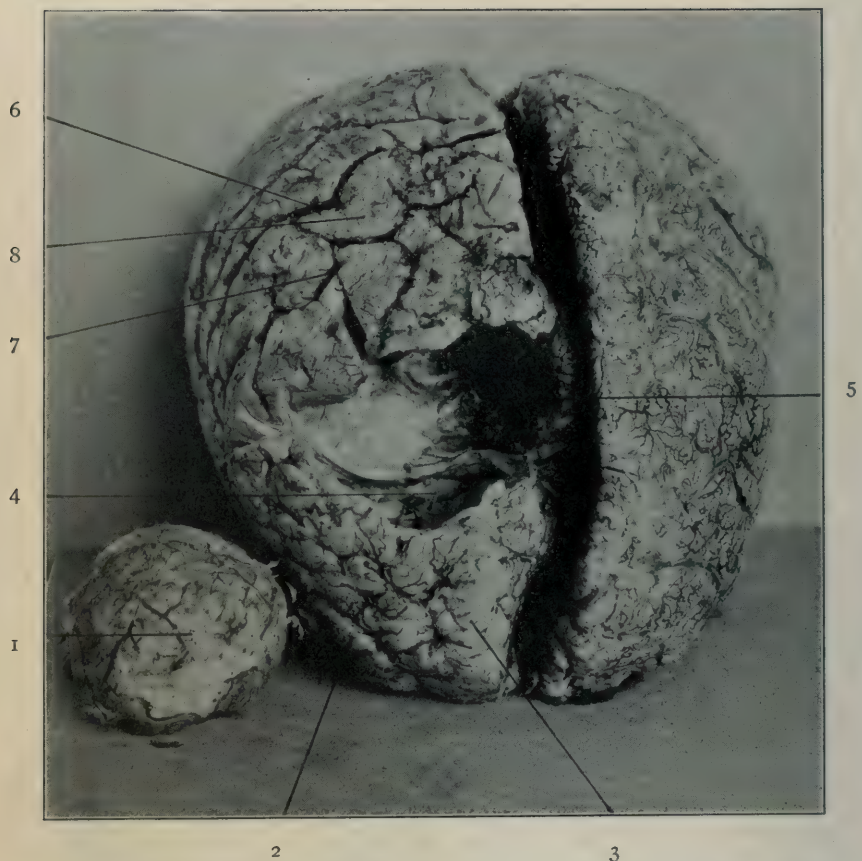
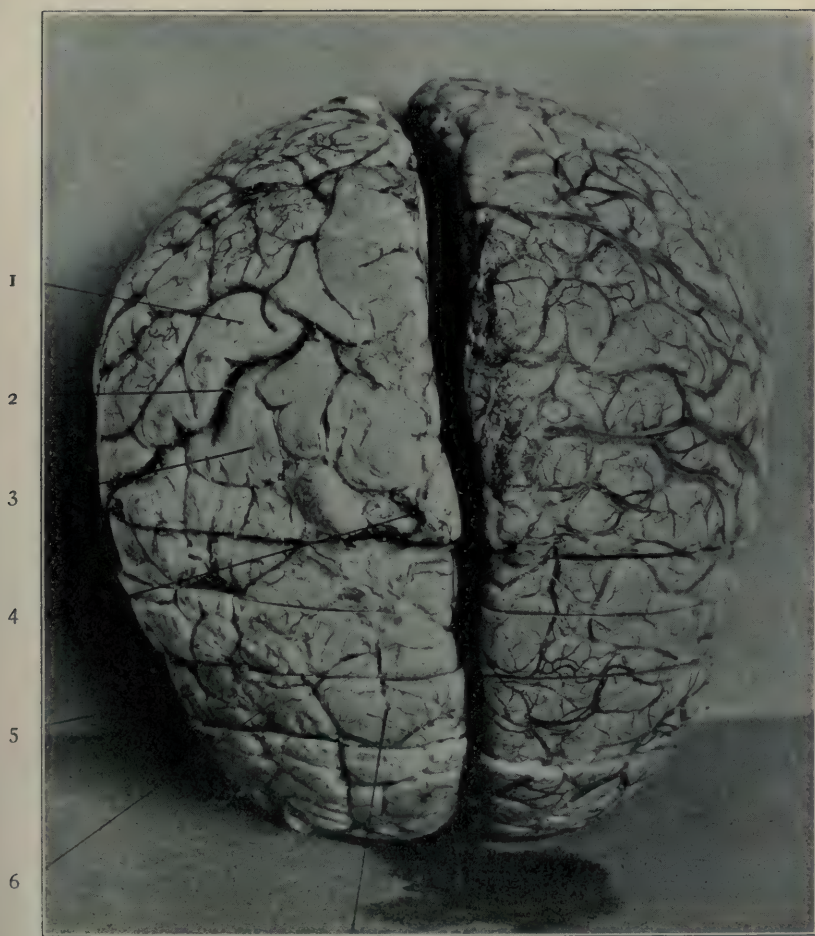


PLATE XI.—Case VI. Angio-endothelioma. 1. Tumor removed from the brain. 2. Middle frontal convolution. 3. First frontal convolution. 4. Anterior horn of lateral ventricle. 5. Displaced first frontal convolution. 6. Rolandic fissure. 7. Præcentral fissure. 8. Ascending frontal convolution.

The location of the tumor is the posterior half of the first and second frontal convolutions extending into the longitudinal fissure. In the depth it extends further posteriorly than is apparent from the photograph. The first and second frontal convolutions have been compressed, but not invaded by the tumor. The ascending frontal convolution has been slightly compressed superficially, but the main compression is below the cortex, in the *corona radiata* and white substance. As observed by those who saw the earlier convulsions, they were limited to the face and arm, without involvement of the muscles of the eye, the head or the neck. Upon admission, the convulsions became general, and no distinctive involvement of the posterior part of the first and second convolutions was observed. The case is characterized by an old injury, with fracture, intense local and frontal headache, and convulsive movements limited for a time to the face and arm (not well observed), and finally general convulsions.

It is to be deplored that the earlier convulsions could not have been more accurately observed, and an early operation attempted.



7

PLATE XII.—Case VII. Encephalitis with abscess. 1. Ascending parietal convolution. 2. Rolandic fissure. 3. Ascending frontal convolution. 4. Tract of infection from the fracture of the skull. 5. Third frontal convolution. 6. Second frontal convolution. 7. First frontal convolution.

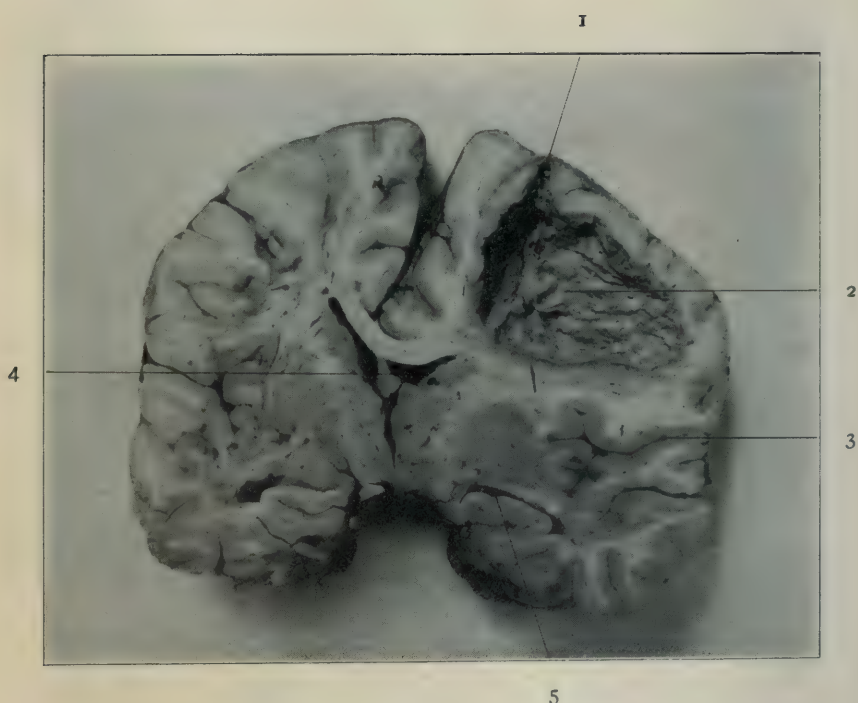


PLATE XIII.—Case VII. Encephalitis with abscess. 1. Track of infection from the fracture in the skull. 2. Contents of abscess cavity. 3. Fissure of Sylvius and Island of Reil. 4. Lateral ventricle. 5. Descending horn of the lateral ventricle.

The bone directly over the perforation communicating with this subcortical abscess is contused (ecchymosis) and shows a compression fracture involving the diploe with a linear crack in the internal plate, beneath which the dura is adherent to the pia. Except at this point, there is no evidence of a pachy- or leptomeningitis.

Bacteriological Examination of the Pus.—Film preparations show many very long chains of streptococci, apparently in pure culture. Cultures from the pus reveal a pure culture of the streptococcus pyogenes.

Ante-mortem cultures made from the spinal fluid remain sterile. No evidence of any sinus or ear disease. Dr. Elser, pathologist, New York Hospital.

The characteristic symptoms here are, (1) The injury to the skull; (2) The severe headache localized to the parieto-frontal region; (3) Tenderness on percussion over this region; (4) The slow pulse rate, 46 to 76; (5) The temperature, 99° to 100°; (6) The blood examination, 8,600 to 12,600 leucocytes, 74 to 83 per cent. of the polymorphonuclear lymphocytes; (7) Microscopic and bacteriologic examination of the cerebrospinal fluid; (8) Focal symptoms limited to the arm and leg; (9) Increasing cerebral hypertension without evidence of meningitis. These symptoms were noticed two and a half weeks after the injury, and continued with increasing stupor and choked discs until death. They were preceded by headache, nose-bleed and slight cortical irritation involving the hand centre, commencing four days after the injury and gradually increasing until admission to the hospital two and a half weeks later. It is to be deplored that an operation could not have been done. Both sides of the frontal lobes must be exposed in most tumors situated in the neighborhood of the optic chiasm, the beak of the corpus callosum, and the internal surface of the frontal lobes (Goldenarm and Winkler, "Chir. Nerv.," Chipault, 1902) or upon the supra-orbital surface of the frontal lobe (Dupré and Devaux, "Iconogr. Salp.," 1901, Bruns, Neurol., *Centralblatt*, 1898).

Two methods of operation have been proposed for this region. Both are cadaver operations.

1. Kiliani (*ANNALS OF SURGERY*, July 1904), recommends for tumors of the hypophysis cerebri a flap with a pedicle just beyond the coronal suture, its sides just beyond the temporal ridges, and its lower border following the usual curve of the frontal sinuses; that is, 1.5 cm. above the orbital margin of the frontal bone externally, near the temporal ridges, and 3.75 cm. above the root of the nose in the median line. This method has its base of 8.75 cm. for its blood supply in the parietal bone at the convexity of the skull where the bone is the most curved and is the thickest. This means that to break it where one wishes, the pedicle must be weakened and somewhat narrowed. Kiliani's operation, however, has the great advantage of following, so far as one can, the margin of the frontal sinuses, and of giving a good exposure without opening the sinuses. The operation is, however, done with a fraise, and the slit left does not allow complete apposition of bone, so that the bone flap rests upon the dura mater, and the healing cannot be so exact as when the bone is in apposition.

2. Duret ("Les Tumeurs de l'Encéphale," 1905), recommends a flap with its pedicle 6 cm. wide, 1.5 cm. above the supra-orbital margin. Its base is situated beyond the coronal suture; its sides extend beyond the temporal ridges. Its arterial supply is through the supra-orbital and frontal arteries. The frontal sinuses are not infrequently opened, a fact which Duret thinks of little importance, as they can be drained. Duret's operation is done with the Gigli saw and the Marion guide. We cannot agree that the opening of any mucous sinus communicating with the nose is an immaterial thing, and we therefore prefer Kiliani's idea of circumventing the sinuses. Our method, we think, gives as good a field as either of these, and, at the same time, allows a ready breakage in the bone at its thinnest portion, namely, the temporal fossa. Our cutters and saws divide the thickest parts of the bone very easily, and for this reason we always make our pedicle (in all flaps) in the thinner sections of the bone.

3. Our flap is a double one, each side of which is made much in the same manner as our flap for exposing one side of the frontal region. Our pedicles are situated in the thin bone of the temporal fossa. Our incision begins externally to the temporal ridge in the neighborhood of the stephanion, crosses the ridge 1.75 cm. above the orbital margin, that is, just above the superciliary ridge, ascending gradually (Kiliani) until a point is reached 3.75 cm. above the root of the nose. Here the incision crosses the median line and descends in a similar manner to a point beyond the temporal ridge, corresponding to the point of commencement. Another incision is now made across the vertex, about 12 cm. long, situated in front of the præcentral line and behind the coronal suture. This line begins and ends just to the side of the temporal ridge. Another incision bisects these incisions just to one side of the median line. Hæmorrhage is arrested by ligature of the arteries, by the buttonhole suture or by the tourniquet. The periosteum is retracted, and the cutter is used. One hole is made at the temporal ridge near the stephanion on each side. One hole at a point 3.75 cm. above the root of the nose, to each side of the median line. Four holes in the upper incision, two at 1 cm. to either side of the median line, two at 4 to 5 cm. in the temporal ridge,—that is, at the extremities of the upper transverse incision. In the vertical incision, to one side of the median line, one hole is made. No more holes are necessary unless the disparity in depth is great between two holes. In that case, another hole may be made to determine the depth. As we usually select a saw 2 mm. less than the actual measurement, we always have a fair margin of safety which we can greatly increase by a bevel. After the bone is sawn, the smaller of these two bone flaps is removed by an osteotome inserted at the point where one noticed that the bone was less divided than elsewhere,—that is, at the thicker portions of the bone. One or two strokes of the mallet upon the osteotome loosens the flap and then it can be raised and broken at its pedicle in the temporal fossa. The other bone flap may be broken in the same manner after loosening the longitudinal

sinus. After the flaps are raised, the dura is exposed and the bleeding from the vessels in the longitudinal sinus are tied. Inspection of palpation of the undivided dura is made. If shock is impending, the operation is discontinued, and is performed in two stages. If so, the bone flap is replaced over gauze packing, and in from seven to fourteen days the operation is renewed.

At this time the procedure will vary, depending upon whether the tumor or cyst can be appreciated upon one side, or whether both sides must be exposed with the dural flap. If one side alone, a dural flap, with its base at the longitudinal sinus, is sufficient. If both sides, or the orbital face is to be exposed, the longitudinal sinus is ligated close to its attachment to the ethmoid and the falx cerebri is divided (Kiliani). The incision in the dura is carried laterally, following the margin of the bone incision, with the base above. The dural flap is raised, spoon retractors are introduced, and the two frontal lobes are raised, exposing at first the olfactory bulbs and the optic chiasm, and later the anterior and middle cerebral arteries between and behind which the hypophysis cerebri is seen. Further back than this level the opto-peduncular space can be seen, though it cannot be reached. Laterally, the orbital surface of the frontal lobes is exposed. Kiliani has looked over 42 cases of tumor involving the hypophysis cerebri, a large number of which were cases of acromegaly, while others were tumors of the pituitary gland, but without symptoms of acromegaly. In no instance have these tumors been removed. In Kiliani's own case the enormous vascularity forbade any such attempt. In 3 cases reported by Horsley the tumor has been successfully removed, with one recurrence (*British Medical Journal*, August 23, 1906). Likewise in the opto-peduncular space, though four tumors have been diagnosticated before death, and found on autopsy, none have been removed.

For tumors and disease of the anterior fossa arising from the bones, the falx or the meninges, this method of incision allows an opening at first upon one side and then upon the other, if necessary. In this manner the operation per-

formed may be accomplished at one sitting, and upon one side if limited and diagnosticated correctly. If extensive, and involving both sides, the bilateral flap may be cut at once. It may be done at one or two stages.

I have had but one case involving this region, and requiring the exposure of both sides at once. This case is Case VIII.

CASE VIII.—H. S. January 30, 1906. Discharged March 17, 1906. Male, thirty-three. *General symptoms*: Eighteen years ago fell and injured skull in frontal region. Seven years later severe headache over the injury occurred. One year ago button of bone was removed, and later two pieces of dead bone. Symptoms of severe headache and pressure beneath the scar remained. A gradual change in his character took place, in which he showed signs of moral perversion. *Localizing symptoms*: Injury, frontal region, headache. *Diagnosis and localization*: Pressure from adhesions. *Operation*: Large quadrilateral flap, base 3 cm. above supra-orbital margin, involving both sides of skull, 9.5 cm. transversely, 7 antero-posteriorly. A thick, dense mass of adhesions involving both frontal lobes (over longitudinal sinus and the first and second frontal convolutions). Removal, Cargyle membrane and replacement of flap. Implantation of celluloid plate, 9.5 x 7 cm. *Result*: Recovery. Relief of headache immediately. Primary union except one small spot where the skin flap necrosed. Secondary plastic. Discharged March 17, 1906. No subsequent changes in moral tone. Headache relieved. October 10, 1906, still healed, no headache, no moral change. January 1, 1907, still free from headache; no other change.

Upon the lateral aspect of the brain the cortical centres for motion, sensation, motor aphasia, word-blindness, or word-deafness and hearing are included in the posterior third of the frontal, the ascending frontal, the ascending parietal, the superior and inferior parietal, the supramarginal, the angular and the first and second temporo-sphenoidal convolutions. This includes:

1. Tumors and disease involving the superior Rolandic and præcentral lobe, a region especially predisposed to the tuberculomata.

2. It includes tumors of the middle Rolandic area (Duret, p. 225, loc. cit.).

3. Tumors and disease of the inferior Rolandic area.

4. Tumors and disease involving a part of the superior parietal convolutions.

5. Tumors and disease involving the inferior parietal convolution and the supramarginal convolution.

6. Tumors and disease involving the first and second temporo-sphenoidal convolutions, in their central and posterior portions.

Tumors and disease under 1 involve the lower extremity; under 2, the upper extremity; under 3, the face, language, and movement of the jaws especially; under 4, alterations in the superficial and deep sensibility are marked symptoms; under 5, astereognosis and deep sensibility are particularly involved; under 6, disturbance in hearing is a marked symptom, and upon the left side, in addition, we have manifestations of sensorial aphasia, except in left-handed people. On the right side sensorial aphasia is wanting, except in left-handed people. We bound this region by an imaginary line, including the posterior half of the frontal convolutions in front, the median line above, the second temporo-sphenoidal sulcus below and the occipital lobes behind. This area includes the whole sensory-motor area which, in order that the flaps be not too large, may be divided into two regions—the motor-sensory or anterior half, and the sensory-motor region, the posterior half. These two regions may, when the necessity arises, be exposed by one flap. But when the symptoms are definitely motor and then sensory, or first sensory and then motor, the anterior or posterior portions may alone be exposed.

It is our practice, unless symptoms are definite, to expose this region by one flap, but we will describe this operation in two flaps. The first flap is bounded by a vertical line one finger's breadth in front of the prærolandic line anteriorly and by a vertical line marking the parieto-occipital fissure, which fissure is found at the posterior extremity of the Sylvian line. The base of this flap is the squamous portion of the temporal



PLATE XIV.—1. Superior longitudinal sinus. 2. Dural flap (rolled up). 3. Superior longitudinal sinus. 4. Frontal crest. 5. Superior frontal convolution. 6. Middle frontal convolution. 7. Inferior frontal convolution.



PLATE XV.—1. Ascending frontal convolution. 2. Præcentral sulcus. 3. Ascending limb of the Sylvian fissure. 4. Inferior parietal convolution. 5. Fissure of Rolando. 6. Ascending parietal convolution. 7. Supramarginal convolution. 8. Fissure of Sylvius. 9. Superior temporo-sphenoidal convolution. 10. First temporo-sphenoidal sulcus. 11. Second temporo-sphenoidal convolution.

bone. The incision is usually commenced upon the anterior and posterior limits. This is followed by the incision 1 to 1.5 cm. from the median line, uniting the upper extremities of the other incisions. Usually, four to six holes are drilled, and measured. In addition to these two or three holes may be drilled to determine any variation in the depth of the skull between these openings. It is not necessary to drill all of these holes, as the second two or three are only for the purpose of determining any great variation in the thickness of the skull. Because of the Pacchionian bodies, these extra holes are sometimes important in the line between the upper extremities of the first incisions. They are equally important at the margin of the temporal ridge, since the variation in depth not infrequently ranges from 1 to 10 mm., and one must know where to bevel and where to saw straight. The bone flap having been sawn, is raised and broken in the temporal fossa. The dura is inspected and palpated and a flap cut. Our flap has usually been with its base above. This is reflected after the middle meningeal artery is tied. It often does not bleed after separation of the dura from the bone if some compression is exerted. If it does not stop, it can be easily ligated. No fear should be had for this artery; no more so, indeed, than in the extirpation of the gasserian ganglion, where it is practically neglected as a factor for or against any particular method of procedure. After reflection of the dura, the field exposed is seen in Plate XV. This, as we can see, gives a full view of all that is necessary about the motor area and, provided localization has been fairly accurate, it should give one sufficient adjacent exposure to correct any slight error. The question of a subcortical or cortical tumor can be best determined, providing the area exposed is extensive.

The number of cases operated upon in this region, of which we have definite information, is 15: 4 traumatic cysts, 1 non-traumatic cyst, 3 cases of adhesions following depressed fracture of the skull or laceration of the brain; 1 endothelioma, 1 gliosarcoma; 1 laceration and hæmorrhage; 4 cases of exploratory operation. The number operated upon but of

which we have no definite knowledge, either by autopsy or examination, longer than one year after operation, is 13.

CASE IX.—A. T. M., Roosevelt Hospital, October 6, 1892–December 26, 1892. Male, twenty-one. *General symptoms*: Injury to head fourteen years ago, followed by aphasia and hemiplegia of right side for eight months. Slowly improved and for seven years was well, speech being slow and hesitating. Seven years ago first convulsions, limited to right side at first, then general. During seven years, convulsions have slowly increased in frequency. *Localizing symptoms*: Injury over motor area. Paralysis with recovery, followed by Jacksonian epilepsy, slowly increasing in severity. No sensory disturbances. *Diagnosis and localization*: Hæmorrhage and cyst. Rolandic area. *Operation*: Trephine and chisels. Omega-shaped osteo-periosteal flap, exposing centre of Rolandic area. *Result*: Cyst found $1\frac{1}{2}$ inches in diameter between dura and pial coats. Dissected away, and flap replaced. Small trephine opening used for drainage. Patient seen 1901, still free from convulsions.

CASE X.—J. H., January 5, 1892, Roosevelt Hospital. February 28, 1892. Single, fourteen. *General symptoms*: Ten years ago fracture of left parietal bone, following which an abscess developed and was incised. Fifteen months ago fell again and struck old spot. This was followed immediately by petit mal. Aura began by numbness in right hand, then flexor spasm in right arms and leg. Such attacks have been repeated frequently (Dr. Starr). *Localizing symptoms*: Aura and Jacksonian attacks in arm and leg: *Diagnosis and localization*: Cyst, result of subdural hæmatoma. In the middle and upper part of Rolandic area, rather posterior than anterior. *Operation*: Quadrilateral-shaped osteoplastic flap removed with chisels over the posterior part of Rolandic area, 8 x 6 cm. Two small communicating cysts removed, situated between the brain and the dura and pia mater. *Result*: Discharged February 28, 1892. Readmitted January 6, 1893. Six months ago convulsion in right side recurred. January 7, again operated and a small cyst removed from original site, including a wedge-shaped mass of brain and scar tissue. Drained. Discharged February 10, 1893, no recurrence of symptoms. In 1889 patient died of pneumonia without at that time having had a recurrence of the convulsion.

CASE XI.—B. C. November 22, 1893, Bellevue Hospital. Discharged December 17, 1893. Male, thirty. *General symptoms*: Fourteen months pistol shot in right parietal bone; ten days later paralysis of right arm and leg, no loss of sensation three and one-half months; gradually recovered. For ten months slight Jacksonian epilepsy, limited to right arm and leg, preceded by headache (severe). *Localizing symptoms*: Depression at site of an old scar, 3.75 x 1.25 cm. The centre of this scar is over the Rolandic area. Jacksonian attacks. *Diagnosis and localization*: Traumatic cyst or adhesions without cyst. *Operation*: Flap, osteoplastic—exposing Rolandic area. Bone found adherent to dura. Beneath it a small cyst found holding 10 c.c. and a small spiculum of bone from the inner table. Removal of wall and drainage. *Result*: Recovery. Discharged December 17. In 1901, heard from; still free from Jacksonian attacks.

CASE XII.—H. F. S., New York Hospital. Admitted February 23, 1905; discharged March 14, 1905, cured. Male, twenty-six. *General symptoms*: When five years old, fell and drove a nail into right side of head. Nail was immediately removed, but during the healing the entire left side of his face and body became paralyzed. This paralysis gradually disappeared, and he was perfectly well for five years, when he began to have epileptic attacks, at first once in every four or five weeks. Attack began by twitching left corner of mouth, then neck, shoulder, elbow, wrist, fingers, thumb, side of body and leg. Sometimes loses consciousness, other times does not. Never falls, has to lie down sometimes; bites tongue. Frequency steadily increased, occurring both day and night, and became so bad that four years ago he was trephined and a cyst removed from brain. No attacks for six weeks, when convulsions began again. For last two to three weeks has two or three attacks both day and night. Between attacks he is perfectly well. *Localizing symptoms*: Scar on right side of head—old trephine. *Diagnosis and localization*: Traumatic epilepsy. A cyst. (Dr. Spitzka.) *Operation*: Osteoplastic flap, quadrilateral in shape (3 inches to a side), exposing the site of old operation. Skull thick, 7 to 10 mm. Dura opened by a crucial cut over site of old injury. Multiple cysts found in region of posterior central convolution. These extended 4 cm. (1½ inches) below surface of brain. All cysts evacuated, fibrous cyst wall dissected out as completely as possible. Hæmorrhage easily

controlled by slight pressure. Dura stitched back in place; small gauze packing at upper posterior angle of wound to control oozing and for drainage. *Result*: Cured. Drain removed on fifth day. All sutures out by eight day. All dressings off on thirteenth day. Left hospital on seventeenth day. Wound solid, primary union. Has had no convulsions. For eight days after operation, temperature 99° to 103.4° , pulse 88 to 120, respiration 18 to 24, then a gradual return to normal. Seen October, 1906. No return of symptoms.

The characteristic points in these cysts seem to be the long period between the original injury and the operative interference, during which time there was progressive increase of the symptoms, from the headache, the paresis or the convulsive attacks and apathy at the times of the injury, to the development of the more pronounced symptoms of cerebral hypertension.

The three stages of such cysts are marked in our 4 cases: The traumatism, epileptic seizures or spasmodic hemiplegia, and the period of intracranial hypertension. Of these 4 cases, 3 were cured, and 1 was unimproved.

CASE XIII.—I. T., New York Hospital, May 10, 1899–July 10, 1899. August, 1900–January 1, 1901. Female, aged thirty-four. *General symptoms*: Nine years ago began to have epileptic seizures, repeated three or four times a year, lasting three or four minutes. Attacks became more severe and more localized in right side of face and right arm. No injury. At present the convulsions are continuous, lasting for days at a time, with but slight intervals. Loss of consciousness. *Localizing symptoms*: Localized, right-sided facial and brachial convulsions (Dr. Peterson). *Diagnosis and localization*: Possible tumor situated in lower third of Rolandic area. Cyst holding 3 drachms found, opened, cut away and drained, communicating with small opening in lateral ventricle. Drainage was excessive and cure tedious. Cured for thirteen months. Return of convulsions. January 1, 1901, second operation, cyst found with many adhesions. Fifteen days after operation convulsions ceased, *i.e.*, with the removal of the drainage and the complete healing

of the wound. *Operation*: Quadrilateral flap from præcentral line to Sylvian line posteriorly, and from the Sylvian line to 1 cm. of median line. Rolandic area exposed. *Result*: After second operation the convulsions were limited to slight twitchings of arm and face at long intervals; this continued for one year, when they became more general, about one a month. (No cure.)

This was a cyst, so far as the history can be obtained, of non-traumatic origin. It communicated by a very small opening with the anterior portion of the ventricle, and was situated beneath the third frontal and ascending frontal convolution. I have always believed that this cyst was of congenital rather than traumatic origin, since no traumatic history has been obtained. It is remarkable that during the drainage, and after the first operation, the convulsions were at long intervals, and consisted of only slight twitchings of the face and of the arm. This continued for one year, when the attacks recurred. Upon reopening the operative field, the remains of the cyst were found, together with many adhesions. Drainage was again employed and relief for about one year occurred, at which time the patient died in a severe convulsion, and no autopsy could be obtained. In some respects, this case is similar to those cases reported by Kocher (*Deutsche Zeitschrift für Chir.*, 1893).

The following are 3 cases of adhesions:

CASE XIV.—G. N. June 13, 1902–July 7, 1902, New York Hospital. Single, twenty-one. *General symptoms*: Injury to right side of head eight years ago. Two years ago first fit, next year two fits, next year three fits. These, as observed, consisted in Jacksonian attacks, confined to the hand and face. During last two years these attacks have become more general, and are attended with loss of consciousness during last year. *Localizing symptoms*: Injury—Jacksonian attacks. *Diagnosis and localization*: Adhesions or cysts. Middle Rolandic area. *Operation*: Osteoperiosteal and muscle flap, 8 x 6 cm., exposing area. Centre of flap is slightly depressed and the seat of old depressed fracture. Well marked adhesions below dura and brain. Removed. Rubber tissue inserted. Depression in bone (3 x 2 cm.) cut out, and cel-

luloid implantation. *Result*: Discharged July 7. Improved. Improvement only temporary—three months fit recurred. No further operative investigation. No further information.

CASE XV.—R. W. New York Hospital. October 25, 1892–December 10, 1892. Single, male, aged twenty. *General symptoms*: One year ago injury to head, left parietal region; was unconscious for several hours, unable to speak, and right hemiplegia for one hundred and forty-two days. Recovered and began to have slight twitchings, limited to hand, arm and leg. These have continued at intervals. *Localizing symptoms*: Jacksonian attacks. Old scar and depressed bone. *Diagnosis and localization*: Depressed bone with adhesions. *Operation*: Omega-shaped flap, skin, muscle and pericranium. Trephine and rongeur for bone, elevating the depression; pieces saved and replaced. Adhesions removed between dura and brain. *Result*: Recovery from operation. No improvement in condition, although patient feels better and speaks better, but the same conditions persist. Though a lesion was found and removed, it must have been imperfectly done, as the same conditions have recurred.

CASE XVI.—W. B., waiter. New York Hospital. February 19, 1906–March 12, 1906. Male, forty-seven. *General symptoms*: Injury to head eighteen months ago. Unconscious at times and for one-half hour. Was operated on for fractured skull; healed in three months. For two or three days after injury, motor aphasia (slight and only when excited did he have difficulty in speaking the word). For eight months has had some irregular sensations, as ringing in ears, spots before eyes, nervousness and paraphasia (motor). Feeling of numbness in right hand and at times inability to hold tightly any object. *Localizing symptoms*: Paraphasia, numbness of right hand below wrist and in foot up to the ankle (Dr. Spitzka). Scar with depressed bone in the frontal and parietal region, 4.75 x 2 cm. *Diagnosis and localization*: Old compound depressed fracture, adhesions and pressure upon brain, rather than a traumatic cyst, involving middle of Rolandic area (Dr. Spitzka). *Operation*: Osteoperiosteal muscle skin flap, exposing the middle Rolandic area from frontal lobes to centre of parietal lobes, *i.e.*, from præcentral to Sylvian lines, and from temporo-sinusal line to 2 cm. from sagittal suture. Transverse diameter of flap is

8 cm. Flap raised with dural adhesions. Dissected away from the pia mater and skull and skin. The space devoid of bone and the pia and brain exposed by removal of adhesions, covered by Cargyle membrane and celluloid plate perfectly shaped—February 24. *Result*: Primary union, March 12. Discharged. Patient feels well and notices no difficulty in pronouncing words which he could not before. Is less nervous. April 27, 1906, no aphasia; working daily. October 17, 1906, no aphasia, full strength in right hand; working daily.

These 3 cases represent injuries with adhesions, and with or without depression of the brain. In one case the possibility of a traumatic cyst was great, though none was found. The remaining cases consisted alone of adhesions. The case of complete recovery was the slightest and the most recent case. It is interesting to observe also that in this case the Cargyle membrane was used to replace the area bared by the removal of the adhesions, and a celluloid plate was inserted into the area bared by the removal of the bone.

The next case was an endothelioma.

CASE XVII.—E. R. New York Hospital. March 25, 1905. Discharged April 25, 1905. Male, forty. *General symptoms*: One year before small tumor, sarcoma removed from inner canthus eye; recurred and again removed. Three months ago began to forget words, and two months ago to use words incorrectly. Severe frontal headache, nausea and occasional vomiting; two weeks ago paralysis of right arm for fifteen minutes and aphasia. Morning of admission became unconscious; some aimless movements and twitching of right arm. Several small subcutaneous tumors exist on the trunk. *Localizing symptoms*: Paralysis of right arm and aphasia for fifteen minutes, followed later by twitching movements in same area and gradually increased pressure. *Diagnosis and localization*: Endothelioma, middle part of Rolandic area. Dr. M. A. Starr. *Operation*: Flap described for anterior part of lateral surface, 10 cm. x 8 cm., duration fifty-three minutes. Tumor found as diagnosticated by Dr. Starr. Tumor measures 3.75 x 3.12 x 2.6. Cavity lined with Cargyle membrane and closed.

Result: Uninterrupted recovery. Discharged April 22. Mental powers, can talk, eat, walk well. Microscopic examination, melanoma of endothelial origin. Patient continued in good health for thirteen months; returned to hospital with multiple deposits in abdominal organs and skin, especially in the liver. He died from these without recurrence in brain.

It is to be noted that this patient remained free from all cerebral involvement up to the time of his death, which occurred thirteen months later, and that his death was due to the involvement of other organs than the brain. It may also be noted in this case that the large bone flap, 10 cm. x 8 cm., with a skull of moderate thickness, 5 to 7 or 8 mm., an exact focal diagnosis and an encapsulated tumor required but fifty-three minutes for its removal from the time of the incision to the replacement of the bone flap after suture of the dura.

The next case was a gliosarcoma.

CASE XVIII (Gliosarcoma).—I. S. New York Hospital. October 17, 1903–December 28, 1903. Male, 48. *General symptoms:* December, 1902, suddenly a convulsion, and could not speak for some time afterward. Nephritis being found, the convulsion was considered uræmic. February, 1903, second convulsion. March, 1903, third convulsion—fixation of jaw, peculiar sensation on right side of face. Mental confusion, but no loss of consciousness. Several such attacks have since occurred, involving muscles of eye, right side of face, loss of power of speech, and then right hand twitches and tingles. No loss of consciousness. June, 1903, Dr. Peterson saw him. October 2, 1903, Dr. Starr saw him. Jacksonian attacks still exist from time to time. He has become mentally dull, with an ataxia of right hand. Eyes normal. *Localizing symptoms:* Jacksonian attacks limited to the eye, face and hand. *Diagnosis and localization:* Tumor in lower third of Rolandic area, extending forward to third frontal convolution. *Operation:* October 20, 1903, flap for exposure of Rolandic region made. Flap measured 10 x 8 x 3 cm. Duration one and one-fourth hours. Cystic tumor found as diagnosticated by Dr. Starr. Removed. Measured 5 x 5 and 2½ cm. Cyst wall removed in part. Cautery

to bleeding vessels. Slight gauze packing. October 29, 1903, flap raised. Cyst wall completely removed with brain tissue. Drainage and reclosure of wound. *Result*: Cystic glioma. Discharged December 28, 1903. Mental condition improved. Walked well, talked fairly well in spite of removal of brain tissue. June 12, 1904, readmitted with recurrence and paralysis of upper extremity complete and slightly of lower extremity. Reopening of wound and recurrence. Recovery from operation, but paralysis again appeared. Died January 12, 1905.

In this case it is to be regretted that such an operation could not have been performed at an earlier date. Though the cyst was enucleated, apparently entire, and care was taken in this enucleation, nevertheless a recurrence took place in twelve months, requiring a second and more extensive removal of the growth, with death during the second year, with further increase of the growth.

The next case was one of laceration and hæmorrhage.

CASE XIX.—E. K.; Roosevelt Hospital, May 7, 1891. Discharged June 23. Female, fourteen. *General symptoms*: Fell 25 feet, striking head. Stupor, not unconscious. Pulse 130, respiration 15. Pupils normal. Three hæmatomata, scalp—one over left parietal, one over right parietal, one over right frontal. Paralysis of right arm, leg and face. Aphasia, motor and sensory(?). *Localizing symptoms*: Injury, paralysis of right arm, leg and face. *Diagnosis and localization*: Subdural hæmorrhage, with pressure from blood clot and laceration of brain. *Operation*: Two days after injury, omega-shaped flap, exposing fracture over left parietal bone. A flap with fractured bone (8 x 4 cm.), chisels used. Extensive subdural hæmorrhage. No extensive laceration of the brain. Replacement of flap, and readjustment of bone fragments. Closed. Recovery. *Result*: Wound closed, June 23. Discharged. Speaks and can use right arm and leg. Seen one year later, still in fine condition. A letter received May, 1903, stated her continued good health.

The foregoing case speaks for the immediate operation as soon as the patient recovers from the shock. The com-

pleteness of the cure, and the want of subsequent symptoms referable to this laceration, speak in favor of the early operation.

The following cases were cases of exploratory operation:

CASE XX.—C. E. L. New York Hospital. October 20, 1901. Discharged November 11, 1902. Female, twenty-seven. *General symptoms*: Tubercular family history. Old purulent otitis externa one month ago. Tonsillitis purulent two years ago. Otherwise healthy. Two months ago, without apparent cause, peculiar tingling sensation in left face, leg and arm, followed by loss of power in same. These last a few hours to two days, and are followed by pain in neck back of mastoid. Ringing in head and deafness in right ear, which has a large perforation. Double optic neuritis, more marked in right eye. Tactile and temp. sense normal. Temperature and pulse 100°–112. *Localizing symptoms*: Tuberculous history. Ear disease, followed by sensory and motor disturbances in Rolandic area. *Diagnosis and localization*: Tubercular meningitis or tuberculoma. *Operation*: Omega flap over the ear, exposing temporal fossa in front and Rolandic area and temporo-sphenoidal lobe; negative. Lateral ventricle punctured and negative. Lateral sinus exposed with burr and found normal. Cerebellar fossa exposed by burr and bone removed. Cerebellum negative. Mastoid cells found normal. As no tumor was found in this case, and as the intracranial tension in cerebellar fossa increased over that in cerebrum, a decompressive operation was done here, and the outer wounds were closed with bone flaps. *Result*: Complete recovery after loss of about one-half cerebellar lobe. Has remained well, and free from attacks; sees better than before operation. Seen October, 1904.

CASE XXI.—Mrs. R. New York Hospital, February 18, 1906–March 3, 1906. Forty-two. *General symptoms*: Six months ago intense frontal and occipital headache; at present numbness and coldness of left knee, leg and finally arm. Difficult articulation. Slight photophobia. Nystagmus in left eye. Tenderness on head over right parietal region. Mentally bright. Pupils equal. No optic neuritis. *Localizing symptoms*: Tenderness over right parietal. Paresis of right face, arm and leg. Increased knee reflex. Many slight spasms in left arm during

examination. Constant paræsthesia of left side. Hesitancy in speech. *Diagnosis and localization*: Cortical or subcortical tumor in right parietal region, upper third, posterior to fissure of Rolando. Fibroma (?) (Dr. Starr). *Operation*: Large quadrilateral flap, bounded by the præcentral and parietal lines antero-posteriorly and from the parietal to the median line vertically. Dura exposed, divided, convolutions exposed and recognized. Palpated, incised and punctured with needle; no tumor found. *Result*: Immediate recovery. No permanent recovery.

CASE XXII.—F. H. December 30, 1905. Discharged February 17, 1906. New York Hospital. Male, twenty-six. *General symptoms*: One year ago vision became blurred. Gradually paresis in back of neck and headache. These increased until June, 1905. Right eye showed choked disc. Occasional vomiting, projectile. Right leg and arm gradually paralytic, with occasional twitching of left face. Gradually became drowsy and more stupid. Antisyphilitic treatment. Two months ago epileptiform convulsions on right side, ending in general convulsions and loss of consciousness. Totally blind two months before admission. Otherwise healthy. *Localizing symptoms*: No localizing symptoms, unless paresis of right leg and arm, with twitching of right face. *Diagnosis and localization*: Tumor of brain. Intracranial hypertension. *Operation*: Temporal region on both sides exposed—dura incised. Search made, no tumor found. Tremendous intracranial tension. Suture of the dura. *Result*: Death two days later. No relief of the symptoms, in fact, convulsions were more frequent after than before operation. Just before death: temperature 105°; pulse 120 to 140; respiration 32. No autopsy.

CASE XXIII.—M. C. M. New York Hospital, March 25, 1904–April 10, 1904. Single, female, twenty-seven. *General symptoms*: Supposed injury to skull. For five years attacks of *petit mal*, with unilateral convulsions in left arm, face and leg, followed by *grand mal*. Aura commencing by pain in the head (right side) and followed by left-sided convulsions confined to arm and leg, with at present complete loss of consciousness. All medicinal and hygienic treatment failed. Family history, alcoholic and insane. *Localizing symptoms*: Involvement of arm and leg, pain in head. *Diagnosis and localization*: No specific diagnosis made. Advised exploration. *Operation*: Large quadrilateral flap made, exposed Rolandic area on right side. Nothing

found. *Result*: No improvement after one month. Considered an idiopathic epilepsy.

CASE XXIV.—H. J. November 30, 1892, Roosevelt Hospital. December 29, 1892. Twelve; male. *General symptoms*: Injury to back of head ten years ago. Two hours later convulsion, lost consciousness. One year ago similar attacks, continuing at times eleven hours. Since then has had an attack once or twice a year, followed by temporary paralysis in right arm, leg, aphasia. Mental condition becoming involved. *Localizing symptoms*: Involvement of right arm, leg and aphasia. *Diagnosis and localization*: Hæmorrhagic cyst. *Operation*: Omega flap exposing Rolandic area. Nothing found upon cortex. Some fluid obtained, 1.75 cm. below the cortex, probably from lateral ventricle. Incision of brain substance revealed nothing. *Result*: Recovery from operation. No improvement. Thought to be an idiopathic epilepsy, of which the Jacksonian attacks were but an expression.

These 5 cases were exploratory operations only, the diagnosis being a tentative one. In none of the cases was a tumor found. In 2, decompressive operations were performed. In 1, (Case XXII) a temporal flap was made upon each side, namely, beneath the temporal muscle. This patient died two days later. In the other, with several trephine openings and a removal of the occipital bone covering the cerebellar fossa, a complete recovery was effected, and she is still alive, having lost all the symptoms of her apparent tumor. One case must be looked upon as an idiopathic epilepsy, of which the Jacksonian attacks are but a part. (Mills, loc. cit.) In the remaining 2 cases there was nothing found. The patients at present are in the same condition as before.

The next flap (the posterior half of the lateral aspect) exposes the ascending parietal, the superior and inferior parietal, the outer portion of the cuneus, the supramarginal and angular gyrus, and the first and second temporo-sphenoidal convolutions. It is especially destined for those cases commencing with disturbances of sensibility, followed by some disturbance in motion of the extremities, with a gradual hemianopsia and loss of language, or for those cases of sen-

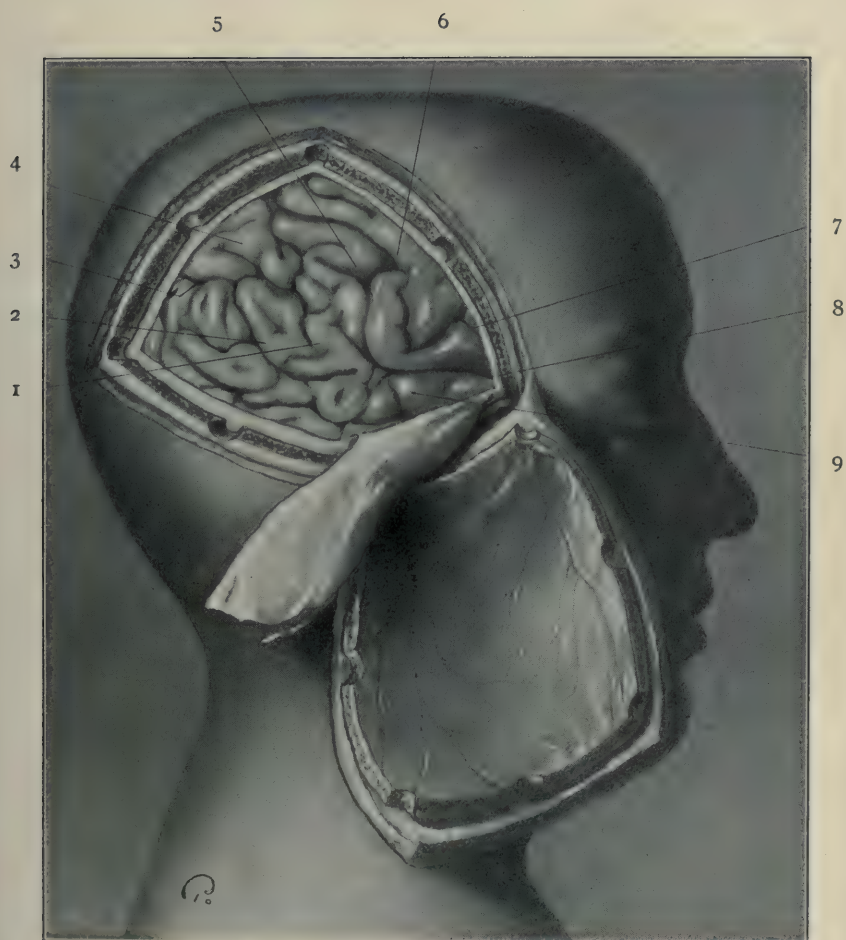
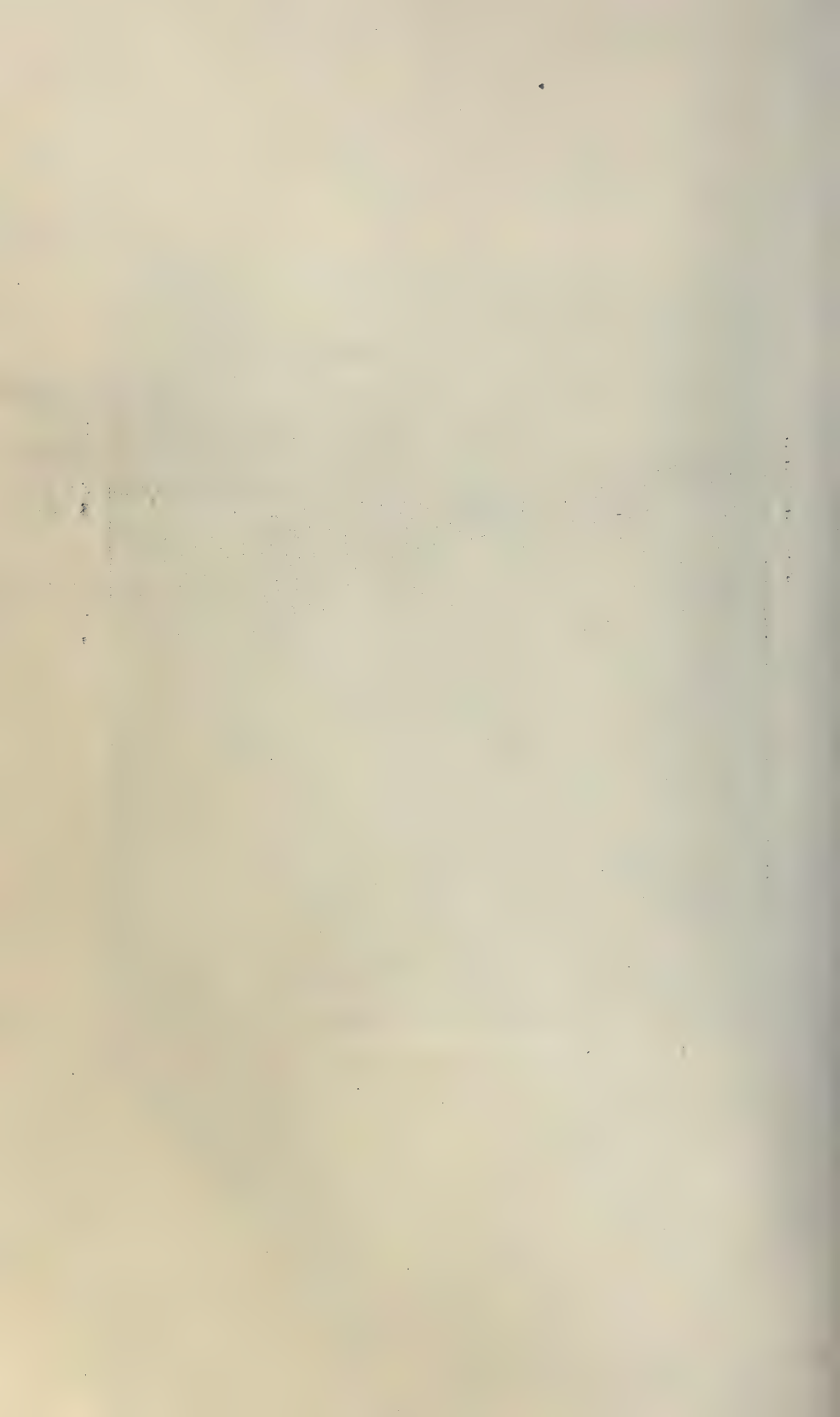


PLATE XVI.—1. Supramarginal convolution. 2. Angular convolution. 3. External parieto-occipital fissure. 4. Superior parietal convolution. 5. Inferior parietal convolution. 6. Ascending parietal convolution. 7. Fissure of Rolando. 8. Fissure of Sylvius. 9. First temporo-sphenoidal convolution.



social aphasia commencing with hemianopsia. The area for language is perfectly exposed by this flap, and it includes, as we know, the third frontal, the first and second temporo-sphenoidal and the angular convolutions. This flap is, in every respect, similar to the former except in its boundaries. The flap starts usually from the junction of the præcentral line and the Sylvian line in front. It crosses obliquely the Rolandic line to the sagittal suture at a point just behind the Rolandic line. The lower or posterior limit follows the 80 per cent. line of Chipault. These two lines are connected by a line parallel to the sagittal suture, 1 cm. laterally. The base of the flap is in the posterior part of the temporal fossa. See Plate XVI.

CASE XXV.—F. B. January 22, 1904–February 17, 1904. Female, thirty-six. *General symptoms*: Two months ago lost sight of both eyes. Stupid and sleeping most of the time, alternating with excitement, weeping and screaming. This excitement seems due to delusions of various sorts. Eyes: pupils dilated and do not react to light. Right optic disc 2 dioptries; left optic disc $\frac{1}{2}$ dioptre. White swelling. Speech not affected. Motions good in arm and leg. Sensation to touch. Localization delayed in the left side slightly, otherwise negative. X-ray shows a slight shadow near tentorium cerebelli. *Localizing symptoms*: Nothing except the sensory disturbances. These were only slight and were not considered of great value. *Diagnosis and localization*: Probable tumor, endothelioma or fibroma. Probably in occipital lobe. X-ray diagnosis negative. *Operation*: Large rectangular flap, including the left parietal to occipital area from part behind Rolandic area to parietal line. Flap raised. Dura incised. No tumor found, though brain was palpated, incised and punctured. Opening of the opposite side was not permitted, owing to the negative find. Flap replaced without bone. *Result*: Patient grew more excited after operation—tore off dressings. This was followed by an infective hernia cerebri and death February 17, 1904. *Autopsy*.—Right parietal region, an endothelioma, 4 cm., antero-posteriorly, 3 cm. transversely, and 5.5 cm. vertically. Tumor is easily enucleated from the brain except on the mesial side, where it seems to blend with a thin layer of brain tissue.

It seems to arise from the meninges and causes pressure upon the brain. The posterior portion of the paracentral and the quadrate lobe have been obliterated. The upper part of the ascending frontal has been pressed upon severely. The meninges showed a diffuse sero-purulent meningitis, due to streptococcus infection. Location of tumor destroying the quadrate and posterior part of paracentral lobule, and pressing upon ascending parietal convolution, gave only as an indication the disturbance in sensation, and the astereognosis which were only slight, and were not considered marked enough for diagnostic purposes. Had the same incision been made upon the opposite side, it would have exposed the tumor, but the infection of the wound after operation precluded it. See Plates XVII and XVIII.

This tumor does not compress the cuneus nor the cerebellum, and therefore produces no symptoms referable to the cerebellum or the cuneus. (Oppenheim, "Traité," p. 125.) Oppenheim reports a case in which this was the condition. The only marked symptom in our case was the hallucinations, while the less marked symptoms were the slight disturbance in tactile sensations and the apraxia on the left arm and leg.

We have consequently, in the lateral region of the skull, 17 cases, 2 deaths, 7 slightly improved or unimproved, 8 cases cured,—that is, remaining well after one or more years.

Of the 13 cases of which we have no records following the operation, our mortality, due apparently to or at least superinduced by the operation, was 15 per cent (2 cases). Our combined operative mortality in this region is then 13.3 per cent.

In the occipital region the area to be exposed in each instance is that including the cuneus, and the first, second and third convolutions; that is, all the portion of the cerebrum behind the middle of the superior and inferior parietal convolutions. This flap will therefore include the space between the point of meeting of the Sylvian line and the sagittal suture above, the temporo-sinusal line below, the sagittal suture in the median line, and a point one finger's breadth above the posterior root of the zygoma in the temporal fossa.

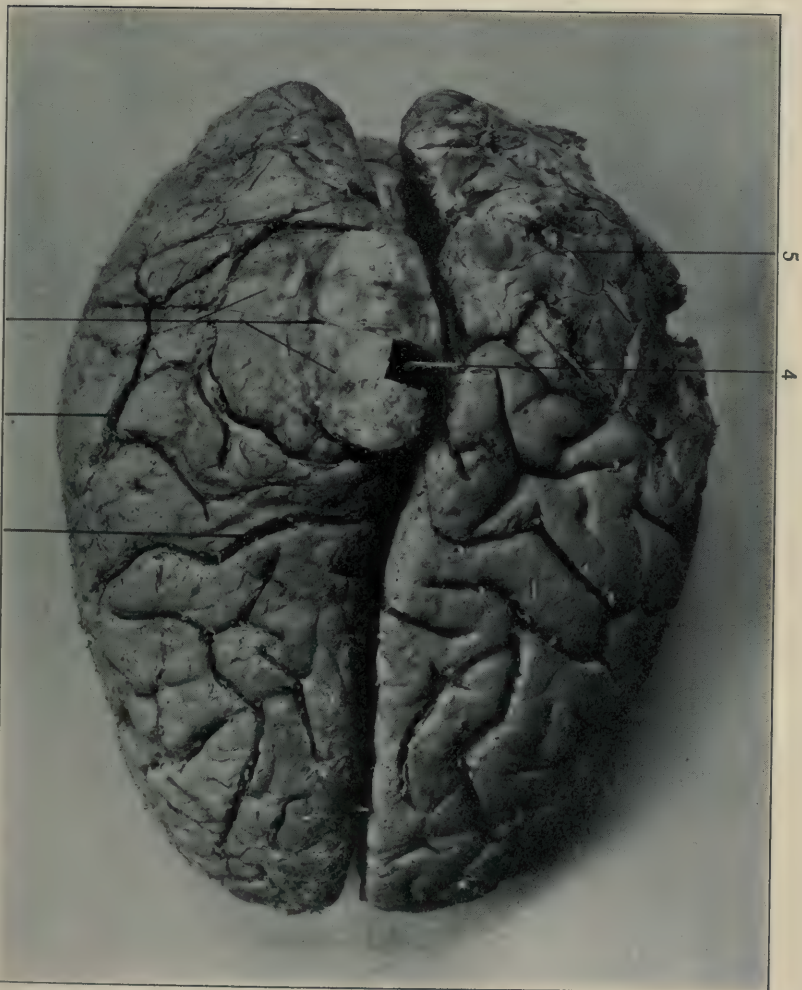


PLATE XVII.—Case XXV. Endothelioma. 1. Rolandic fissure. 2. Sylvian fissure. 3. Tumor and line of section of tumor shown in Plate XVIII. 4. Section taken from tumor for pathological examination. 5. Site of operation.

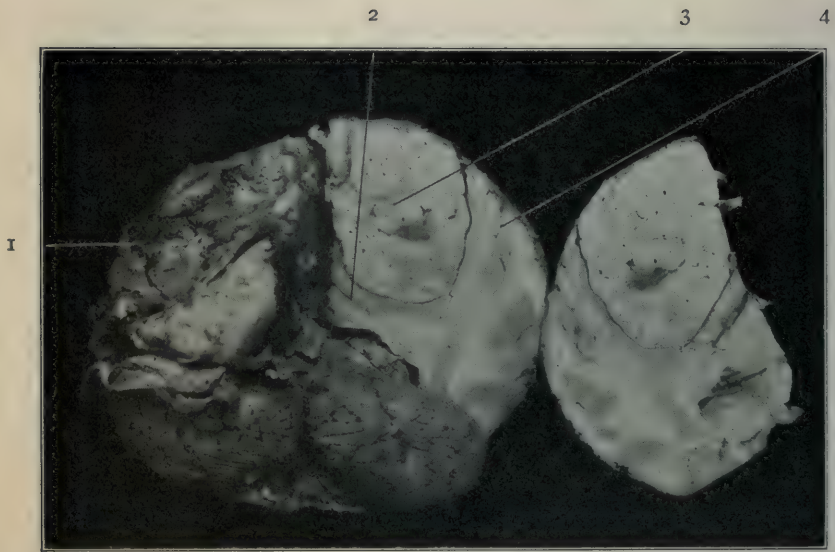


PLATE XVIII.—Case XXV. Endothelioma. 1. Site of operation. 2. Parieto-occipital fissure. 3. Tumor. 4. Sylvian fissure. 2, 3 and 4 show the transverse section of the tumor and brain at the point shown by Fig. 3 in Plate XVII

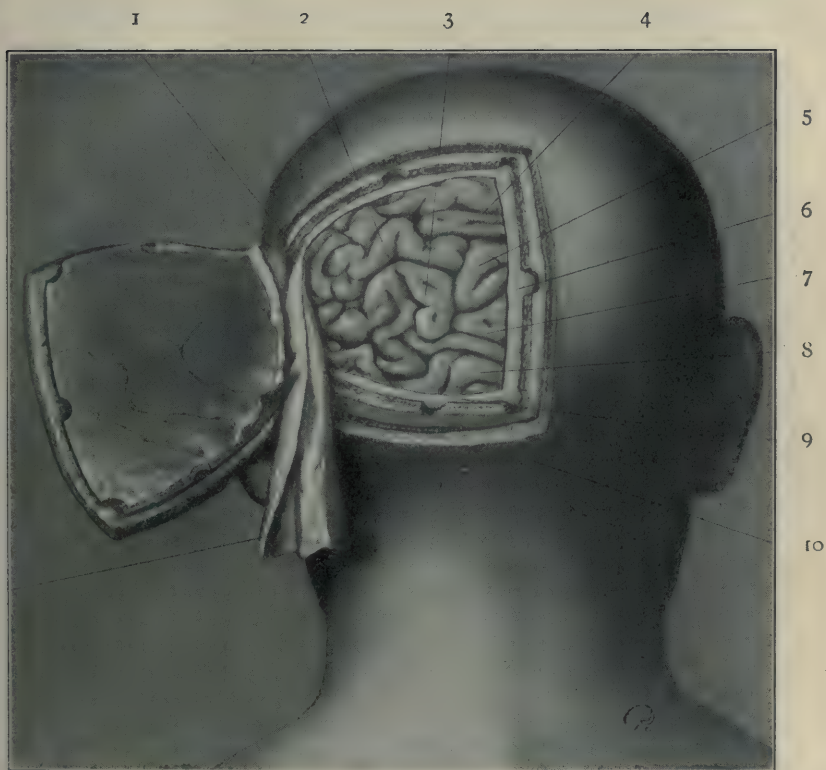


PLATE XIX.—1. Supramarginal convolution. 2. Inferior parietal convolution. 3. Angular convolution. 4. External parieto-occipital fissure. 5. First occipital convolution. 6. Superior longitudinal sinus. 7. Second occipital convolution. 8. Third occipital convolution. 9. Lateral sinus. 10. External occipital protuberance. 11. Dural flap.

In this region of the skull exposed by this flap, we have one case.

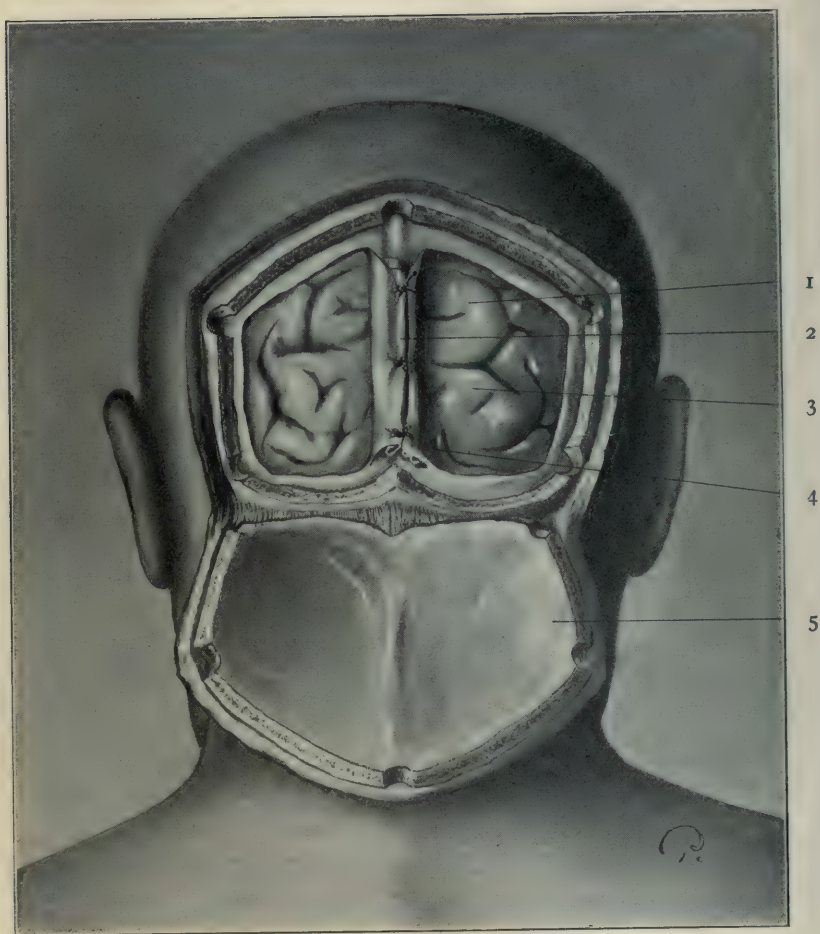


PLATE XX.—1. Superior occipital convolution. 2. Dural flaps. 3. Second occipital convolution. 4. Third occipital convolution. 5. Reflected bone flap.

This form of flap is (see Plate XIX), in our opinion, the best because it exposes the cuneus and lingual lobes, and permits a view of the inferior parietal and angular convolutions, and it may be extended forward at its base if there be any need of exposing the convolutions along the Sylvian fissure. Its blood supply is from the temporal artery, and is good. The bone breaks in the thinnest portion, and the thicker parts of the skull are now divided with the saw. The shape and extent of the flap may be sawn and broken as one wishes, without the danger of having it break at some undesired portion, with the consequent prolongation of the operation, and the increase of shock.

Our incision commences at the temporo-sinusal line in the temporal fossa, near the posterior root of the zygoma above the external meatus. It passes to a point 1 cm. laterally from the median line, parallel to and above the temporo-sinusal line. Here it ascends 1 cm. above the Sylvian line, whence it turns and follows this line until the temporal ridge is passed and the squamous portion of the temporal bone is exposed. The first incision in this flap divides the occipital arteries and they require securing. The second incision requires a ligation of the vessels from the opposite side. The anterior incision comes in contact with the temporal arteries. The hæmorrhage must be secured first, because in this portion of the scalp the vessels are large and bleed to a large extent. For this reason we usually use a tourniquet and often the buttonhole stitch (or the metal plates of Kredel). We usually make seven holes in all: two in the temporal fossa at the beginning and end of the incisions; one each half way toward the median line in the upper and lower incisions; finally, two at the extremities of the first and third incisions, near the median line. After drilling and sawing, the flap is raised. It usually breaks in the temporal fossa, opposite the junction of the posterior and middle third of the Sylvian fissure, so that a perfect exposure of this region is obtained. The posterior branch of the meningeal artery is exposed in the lower angle, and above it upon the upper surface of the dura mater one or two vessels may be

seen, passing into the longitudinal and transverse sinuses. These, however, are not difficult to secure. The dura is usually incised in the line with the bone flap, and with the base towards the temporal fossa. It may have its base in the opposite direction, if one wishes, though we prefer the base to correspond with the base of the bone flap. When reflected there is exposed the posterior portion of the superior parietal, a part of the supramarginal, the whole of the angular gyrus, and the three occipital convolutions. By retraction outward of the brain, the præcuneus, cuneus and part of the lingual lobe may be seen. The enucleation of a growth in this region by this incision would not be difficult, provided it did not involve the lingual lobe where, if it were small, it might easily escape observation; while in the other lobes the same growth may be more easily identified and enucleated. Such a case as this has been recently operated upon in two stages, by Krause, assisted by Oppenheim, and an account of which is given in the *Berliner Klinische Wochenschrift*, Dec. 17, 1906.

The patient was a man of thirty-five years, who, after suffering for some weeks from headache, developed right-sided hemianopsia, optic neuritis of the right eye, vertigo, vomiting, bilateral choked disc most pronounced on the right side, and partial alexia and agraphia. A little later right-sided hemihyperæsthesia, hemiataxia, and hemiparesis developed. It was believed that from the clinical signs the tumor could be located in the occipital region of the left side, and operation was decided upon and performed in two stages three and a half months after the onset of the headache. At the first stage a large quadrilateral bone flap was made over the occipital lobe, exposing the lateral and longitudinal sinuses. Sixteen days later the wound was reopened and the dura incised. The tumor could be immediately seen occupying the lower median angle of the opening made, and it was easily removed by blunt dissection. It measured 32 x 55 x 58 mm., and was egg-shaped. On microscopical examination it was found to be a spindle-celled sarcoma. The second operation lasted only one-half hour and there was little loss of blood, but during several days the patient was in a very precarious condition owing to high temperature and rapid and feeble heart action. He ultimately recovered completely, the only symptoms persisting being a moderate contraction of the right visual field, while otherwise he is entirely free from difficulties.

CASE XXVI.—R. M. May 23, 1906; discharged June 3, 1906. Twenty-one; single. *General symptoms*: Day before

admission struck on head with a bale hook. No loss of consciousness. Small punctured wound, 1 cm. long, from which brain matter escapes. Wound enlarged and puncture into brain found. Vomited occasionally; eyeball moves in every direction. Pupils react to light and accommodation, equal, moderately dilated. Homonymous hemianopsia. Four hours after admission became somewhat dull, and complained of headache (frontal). Pulse irregular, slow. Increased tension. *Localizing symptoms:* Homonymous hemianopsia. Injury to skull. *Diagnosis and localization:* Diagnosis, punctured wound of the angular convolution(?) (lobule de pli courbe). *Operation:* Rectangular osteoplastic flap, with base in temporal fossa above the mastoid (burr, drills and saw). Flap raised, exposing the under surface of bone and showing the tearing away of the inner table 2.5×2 cm., while the hole was .5 cm. in diameter. Dura torn and lacerated, admitting the finger. Brain lacerated over the angular gyrus and for a depth of 1 inch (2.5 to 3 cm.) The three occipital lobes, the external parieto-occipital fissure and the supramarginal convolution were recognized. The puncture was between these points. Clot removed. Area covered with Cargyle membrane, drainage with gauze. About one-half the bone was removed to facilitate the drainage. Dura sutured. *Result:* May 28, wound closed. Hemianopsia almost gone. June 3, hemianopsia gone.

This case seems to show that a lesion situated cortically at the junction of the occipital, the angular and the inferior parietal lobes, extending 2.5 to 3 cm. in depth, will produce a bilateral hemianopsia, of which the patient was not conscious until his attention was called to it. Then he appreciated distinctly that his field of vision in each eye was limited to the same side as the lesion. The optic radiations of Gratiolet were probably involved.

If both sides of the occipital region are to be exposed at once, it seems to us less of an operation to make a flap including the occipital region below the Sylvian line of each side, with the base at the two temporo-sinusal lines. This form of flap will not make such an advantageous opening for either side; but if both sides must be exposed at once, it seems to offer an advantage over the two separate side openings, in that

there is less drilling and sawing required and consequently less hæmorrhage to be overcome, but the exposure is not so advantageous as is that obtained by the two lateral occipital flaps. Our incisions for the single occipital flap exposing both sides pass upon each side from the junction of the outer and middle thirds of the superior curved line upward and slightly outward to the Sylvian line, at which point they follow this line to the median line, where they meet,—that is, at a point 70 per cent. of the distance from the nasion to the inion. These incisions are carried directly to the bone, the arteries ligated, and the hæmorrhage checked as in all other operations. The drill holes are placed as follows: one on each side, .5 cm. above the tempero-sinusal line, one on each side of the angle of the incision over the Sylvian line, and one on each side of the median line. The saw is used and the bone is broken at the tempero-sinusal line, parallel to the transverse sinuses. The hæmorrhage from the transverse and longitudinal sinuses may be brisk, but it usually may be stopped by pressure or suture with Mata's needles, which I have threaded and ready for use. The dural flaps have their bases at the longitudinal sinus and are reflected over it. The parts exposed are similar to those exposed by the lateral occipital flaps, but not so thoroughly.

CASE XXVII.—O. O. New York Hospital, April 21, 1906; discharged May 14, 1906. Male; twenty-one. *General symptoms:* Fell great distance, striking head; was unconscious fifteen minutes. Is stupid, answers questions, but cerebation is slow. Movements of eyeball perfect, pupils react sharply. Is totally blind. No paralysis nor anæsthesia in face, arm or leg. Grip in hands good. Legs contracted with power. Knee jerk not exaggerated. Depression in skull opposite centre of the occipito-parietal suture, with scalp wound 2 inches long. Pulse slow, 60-70; temperature 99.6°; respiration 16-24. *Localizing symptoms:* Total blindness. Depressed fracture over occipital region. *Diagnosis and localization:* Pressure upon occipital lobes both sides by bone and hæmorrhage. *Operation:* Large flap including periosteum formed 8 x 7 cm., exposing the depressed bone, 7 x 7, and circumventing the three occipital

convolutions upon both sides, (*i.e.*) from the Sylvian line above to the temporo-sinusal line below. Bone reincised. Lines of fracture extended to right side toward foramen magnum, loosening the greater part of the occipital bone on that side. Dura injured only over small area. Large subdural hæmorrhage, extending over the occipital lobe and into the longitudinal fissure to the tentorium cerebelli. Dura incised on both sides of longitudinal sinus and clot allowed to escape. Dura sutured and a celluloid plate (7 x 7) moulded to approximate the curvature of the skull. *Result*: April 23, 1906, distinguishes light and darkness. April 24, sees objects moving before eyes. April 25, counts fingers before eyes. April 27, recognizes faces. April 29, can see 50 feet, printed matter with letters 1 inch high. May 14, sight perfect.

If not contraindicated, we prefer after the exposure of one side of this region to add to our lateral flap a similar, though not so extensive flap, upon the opposite side. The hæmorrhage and the sawing necessary to accomplish this may be a little more than is required for the single flap, but it is our opinion that the exposure obtained is worth the risk run and the time expended in making the flap, for the operation may be done under these conditions, in two stages rather than in a single-stage operation.

Such a flap is represented in Plate XXI.

The last two cases, and which were situated upon the occipital region, are important in that they show the necessity of early operation in order to secure rapid recovery and perfect functional restoration. In both of these cases the subsequent perfect restoration was due undoubtedly to the early operation, avoiding the possibility of sepsis, and allowing complete restoration of the brain tissue by the removal of the clot in its substance.

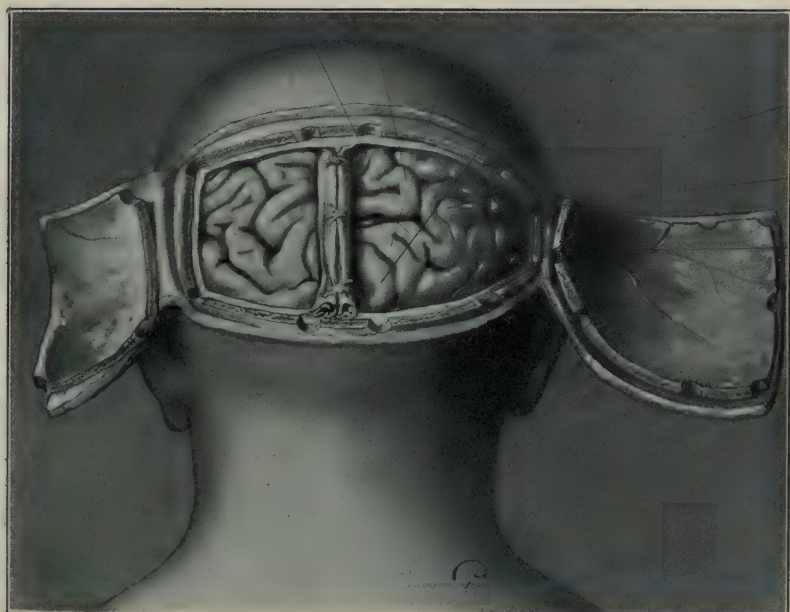
In addition to these cases already reported, we have two more, situated in other regions of the brain, but nevertheless interesting. The first of these cases is the following:

CASE XXVIII.—*Cystic Glioma, filling Third Ventricle and projecting at the Base between the Crura.*—Admitted February 5, 1905, to the New York Hospital, Medical Division (Dr. Loomis). Transferred February 19 to the Surgical Division. Female, eighteen. *General symptoms* (December 4 to 24, 1904): Treated for anæmia and amenorrhœa. Sharp pain in both temporal regions and top of head, followed by unconsciousness, sixteen months ago. Several similar attacks since then. They occur now three times a week and will last often three hours. For the last six months numbness, tingling in hands, arm and feet. Gait unsteady; staggers to both right and left side. During the attacks there is marked projectile vomiting and involuntary urination. No double vision; strabismus. Always has been hard of hearing. *Localizing symptoms*: Eyes: Pupils small, react slightly to light and accommodation. Right optic, disc swollen, central depression lost, margins ill defined, arteries small. Left optic, disc shows the same changes but less marked. Extremities: knee jerks exaggerated; no œdema; no ataxia. Slight Romberg. Staggers more to the right. Ocular muscles are normal. Tongue deviates to the right. Eleven days before she died became totally blind in right eye; vision left eye limited to 5 feet. Exophthalmos gradually became worse. Slight general convulsions appeared. Leucocytes 14,000; temperature 99–100; pulse 96–112; respiration 18–24. General hyperæsthesia. Six days before death eyes became fixed and turned toward left; pupils contracted and inactive. Muscles of right arm and leg spastic; muscles of left arm and leg flaccid. *Diagnosis and location*: Cerebral tumor, localized to right side of pons varolii. *Operation*: No operation. *Result*: Died February 21, 1905, in convulsions.

Histological Examination.—Cystic glioma with hæmorrhage.

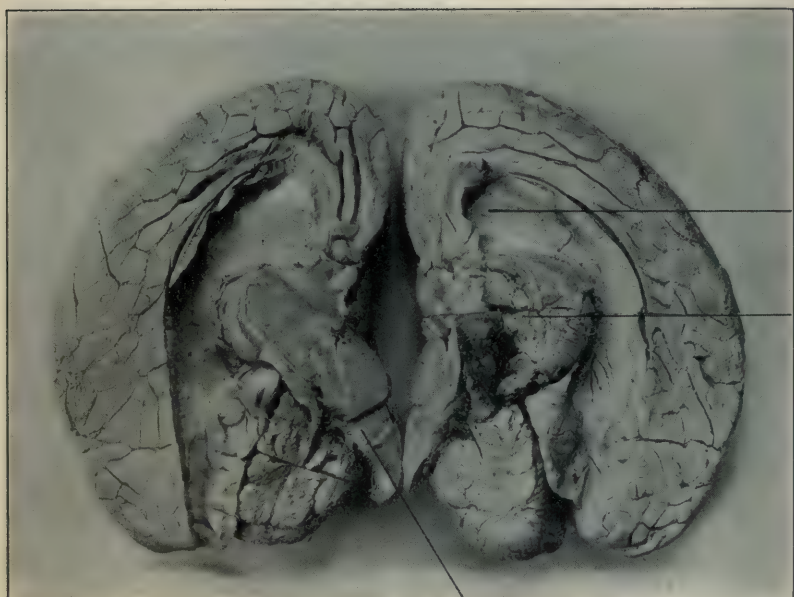
Pathological Report.—Base of brain: The tumor with a thickened capsule forms a nodular projection at the base of the brain in the space formed by the crura cerebri and optic tracts. It folds backward over the anterior commissure, to which it is attached. Measures $\frac{3}{4} \times 1\frac{1}{2}$ inches. The anterior half of the pons is indented by the growth, but the stumps of the fifth nerve are free and unattached. The third nerves emerge from the crura beneath the growth and are apparently not atrophied; the optic nerves are smaller than normal; the cranial nerves of the medulla are negative; the arteries of the circle of Willis are normal.

1 2 3 4



5
6
7

PLATE XXI.—1. External parieto-occipital fissure. 2. First occipital convolution. 3. Second occipital convolution. 4. Third occipital convolution. 5. Angular convolution. 6. Supramarginal convolution. 7. First temporo-sphenoidal convolution.



3

PLATE XXII.—Case XXIX, Glioma. 1. Lateral ventricle, 2. Tumor with hæmorrhagic area. 3. Pons and medulla from which a section has been removed for examination.

Interior of brain: There is a high degree of hydrocephalus; all horns of the lateral ventricle are enormously dilated; the cavity of the third ventricle is completely filled up with tumor mass which rises on either side in the foramina of Munro as whitish eminences. The surface of the growth is smooth and encapsulated. Posteriorly, the growth has compressed the corpora quadrigemina and adjacent portions of the cerebellum. Transverse section through junction anterior and middle thirds of third ventricle reveals a cystic mass with hæmorrhagic areas between the optic thalami. At the circumference there is a margin of whitish translucent tumor tissue sharply circumscribed and more or less encapsulated. The pineal gland and hypophysis cerebri are not distinguishable in the tumor mass. Transverse sections through pons and medulla show only pressure—no infiltration.

"The tumor itself was inoperable, but a decompression would certainly have been of service."—J. Ramsey Hunt.

This case is very similar to one reported by Grenet, except that in his case the pituitary body was not involved by the tumor. (*Société Anatomique*, 1898, p. 90.) Many cases presenting in the optopeduncular space, are also mentioned by the same author.

CASE XXIX.—Admitted New York Hospital, December 12, 1904. Died December 14, 1904. Male, seventeen. *General symptoms*: About one month ago began to have pain and stiffness in muscles back of neck, also frontal headache. These symptoms have gradually become worse. Two weeks ago staggering gait, vomiting and dimness of vision appeared. Is becoming more and more drowsy, is in a stupid condition most of the time. Duration of observation, six weeks. Dr. A. L. Fisk. *Localizing symptoms*: Optic neuritis both eyes, more marked in left in which it started. Partial blindness, drowsiness. *Diagnosis and localization*: Cerebral hypertension from tumor(?). *Operation*: December 13, 1904. Chloroform; scalp and periosteum turned down from left superior curved line, exposing occipital bone. A burr opening was made in this region and enlarged with rongeurs. Cerebellum bulged $\frac{3}{4}$ inch, little pulsation. Explored with needle and finger, nothing found; needle

then inserted upward through tentorium, also negative. Scalp returned and sutured, rubber tissue drain. Small burr opening then made in occipital bone, opposite side (right side). Cerebellum did not bulge. Needle inserted, nothing found. Scalp returned and sutured. *Result*: Died.

Autopsy.—The opening in right occipital bone is 1.5 cm. in diameter and is in the centre of the right posterior fossa. The opening in the left occipital bone is about twice as large and its upper border corresponds to the lower edge of the lateral sinus. The dura has been opened and softened cerebellar tissue protrudes slightly. The meninges are normal. The cerebral convolutions are everywhere moderately flattened without any appreciable difference in degree in any region. The lateral ventricles are moderately enlarged and contain an excess of serous fluid. Owing to the presence of a soft, partly gelatinous tumor, which is limited to this ganglion, the right optic thalamus measures 5.5 cm. anteroposteriorly, 3.5 cm. transversely, and 3 cm. vertically. There is marked flattening of the inner surface of the left optic thalamus, owing to pressure by the tumor. The posterior and inner part of the growth is the seat of hæmorrhage and the capsule has been ruptured, allowing the gelatinous tumor tissue to escape and partially fill the fourth ventricle. Whether this rupture occurred during removal of the brain or prior to this cannot be stated. Microscopical examination shows the tumor to be a very cellular glioma. The cells are of the small type. There is an abundant vascular supply and the vessels as a rule have very thin walls in proportion to their size. There are small areas of necrosis scattered through the growth.

Though the tumor was a large one and involved the optic thalamus, the symptoms were only those of cerebral hypertension.

POSSIBILITIES AND LIMITATIONS OF BRAIN SURGERY, WITH ESPECIAL VIEW TO TRAUMATISMS.*

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BRAIN surgery is still in the hands of the general surgeon, assisted in diagnosis frequently by the neurologist, and while not in itself a specialty, calls, perhaps, for more special knowledge and skill than any other branch of general surgery. From the close anatomical proximity of the organs of special sense to the brain and the relation of their different pathologies to various brain lesions, the eye, ear, and nose specialists, in particular, find their operative work often concerned with the brain and its envelopes, and consequently must be familiar with the principles and technique of this subject. They should also be able to dissect the triangles of the neck in case of sinus thrombosis.

Brain surgery necessarily includes that of its bony capsule, the cranium, as well as its membranous and vascular envelopes, the meninges. The necessity for such surgery is essentially threefold: 1. The presence of new growths, either of the viscus itself, or its envelopes, constituting the elective class; 2. The various results of trauma, such as fractures, accompanied or followed by depressed bone, hæmorrhage (later cysts) and abscess or meningitis resulting from direct infection; 3. Metastatic processes from septic conditions in the skull or adjacent bony sinuses—the last two making up the emergent class.

In a general way the difficulties or limitations are: 1. The relative difficulty of access to this viscus compared with that of reaching the various organs and viscera in the three other chief

* Read before the Practitioners' Club of Jersey City, December 4, 1906.

cavities of the human body; 2. The great desirability, if not necessity, and the frequent difficulty, if not impossibility, of a precise pre-operative geographical diagnosis. In the thorax, abdomen and pelvis explorative operations are feasible without a pre-operative diagnosis, while within the skull they have usually been considered prohibitive, or at least of very doubtful expediency; 3. The fact, closely allied with the one just stated, that symptoms of brain lesions are not infrequently delayed, and even when manifest are often misleading, coupled with the other fact, that lesions in the so-called "silent regions" of the cerebrum, viz., the first and second frontal convolutions with most of the occipital region, generally give us no leading symptoms.

The possibilities of improvement in brain surgery lie chiefly in a clearer knowledge of regional function, and its interpretation by symptoms—in other words, better diagnosis. For instance, Krause, of Berlin, by the use of local faradization, while exciting cortical centres in the human brain, in operations for Jacksonian epilepsy, has taught us that the motor area occupies not the ascending frontal and parietal convolutions, but the ascending frontal only; while the speech centre, instead of being single and located in Broca's convolution, is threefold, with as many anatomical distributions. Increasing use is also made of the ophthalmoscope to determine eye conditions having some bearing on brain lesions.

The work of Keen and Sir Victor Horsley have shown the possibility and expedience of removing or breaking back large bone areas for explorative purposes, when diagnosis is presumptive but not positive.

The tolerance of the brain itself to aseptic explorative puncture, incision, etc., is increasingly apparent.

In exploring for brain abscess the best instrument is the dull spatula-like knife of Horsley, which on being introduced and pressed slightly one way and the other allows more ready outflow of pus, where it exists, than does a director.

If pus appears, never withdraw the knife or director until a pair of forceps is passed down to the cavity and spread sufficiently to allow evacuation and subsequent passage of a drain,

preferably a soft rubber tube or rubber tissue, as gauze does not drain pus but rather causes retention. If the exploring instrument be withdrawn before introducing a spreading forceps the location of an abscess may easily be lost, as the soft brain matter rolls in and obscures the explorative track.

The usual order of symptoms of brain abscess are headache, somnolence, deepening into stupor, slow pulse and moderate temperature variations, usually preceded by trauma of skull or disease of one of the bony sinuses. The headache, however, may be very transient, or the patient may be first seen in the stage of somnolence or coma, when the case may be confused with uræmia, continued fever, alcoholism, etc. The pulse may be rapid instead of slow and the temperature may run high.

Meningitis may be compared in the cranial cavity to extensive peritonitis in the peritoneal cavity, but offers less hopeful outlook to operative treatment, although drainage is sometimes, though rarely, successfully attempted.

Disease or injury in the motor areas offer the best opportunity for operative treatment when consciousness is not lost; but the surgeon should not forget that abscess or tumor in the "silent regions" may, by transmitted pressure, simulate motor area conditions, and so mislead attempts at geographical diagnosis. It may be noted, in passing, that lesions of the frontal lobe are not infrequently followed at a later period by changes of temperament or disposition.

Many have been the interpretations of pupillary changes, but it is now pretty generally held that while contraction, dilatation, inequality, etc., occur as the result of brain lesions we know practically nothing about the exact relationships. It probably is safe to assume this much, that a persistently irresponsive pupil indicates cerebral trouble.

Choked disc or "high-grade optic neuritis" is not a sign of much value in emergent or traumatic brain surgery, as it rarely exists in intracranial hæmorrhage or brain abscess. It is most characteristic of brain tumors.

Cheyne-Stokes breathing is a concomitant of the late

stages of meningitis, being generally a precursor of death. Its cause is in dispute, but is probably due to alternating anæmia of the respiratory centre in the medulla.

In traumatic conditions of the brain, consciousness or unconsciousness, pulse rate, tension and temperature, and of course localizing symptoms, if conscious, are the most important factors in determining diagnosis, prognosis and plan of treatment. Of all these the temperature course is probably the best index of the severity of the lesion. It is considered important in unconscious cases to know whether or not there was even a brief interval of a few minutes or seconds of consciousness before stupor or coma began. It is pretty well recognized to-day, however, that long continuance of unconsciousness means either extensive pressure by depressed bone or blood clot, or else brain contusion. The form of contusion under consideration is really an organic injury of serious import, owing to disintegration of brain cells and consequent cerebral œdema, not dependent on pressure, and consequently not amenable to treatment by trephining, incision of dura, etc.

This water-logged condition, dependent on loss of cell vitality, is often overlooked, even at autopsy, unless accompanied by excess of serum in the ventricles and arachnoid space, but is none the less, when it exists, an almost invariable cause of death. We suspect this serious form of œdema in cases of prolonged stupor, rising and, *later*, irregular temperature, and should recognize the futility of operation for relief of presumed intracranial tension which either does not exist or else is incapable of relief, because the tension-producing element is not superficial, but intimately distributed throughout the brain substance.

CASE I.—A. V., aged ten months, fell a distance of about 8 feet—immediately unconscious. Two hours later I saw the child in consultation. Shock was profound; convulsions involving both right extremities, and afterwards the left as well; pupils somewhat unequal; pulse barely perceptible; surface cold and clammy. I declined to operate because of general condition and

ignorance of the locality of lesion on account of the general and multiple symptoms. A tentative diagnosis of cerebral hæmorrhage with extensive clot formation, or, more probably, serious general contusion, was made. For many days the infant hovered between life and death, afterward developing spastic contractures of all extremities, and finally passed from my observation because of my absence from the city. At a period of about six weeks after the injury Dr. Starr saw the case and diagnosed cerebral hæmorrhage with clot formation, focal intensity over left motor region. A rapid trephining, with nearly a fatal termination, on the table was done, with escape of about 2 fluid drachms of serum, followed by disappearance of spastic contractions, the patient dying, however, five days later. This relief of spasm must be considered in the nature of a triumph for surgical intervention in spite of almost insuperable limitations and the final fatal result.

1. The question arises whether the infant's general condition would, at any time, have permitted successful (curative) operation. In my opinion it is very doubtful. 2. Diagnosis—A blood clot sufficiently large to cause such extensive and manifold symptoms should have resulted in a larger quantity of serum at operation. The theory of general contusion within involvement of vitality of a multitude of cells seems more probable, as it would account for the profound shock and numerous symptoms, without a large amount of free serum. In such a case operation at any time must have failed.

CASE II.—T. H., aged twenty-five, alighted, at night, carelessly from a moving train; fell and sustained a scalp wound in the upper part of the forehead near the median line. A local physician decided that there was no injury to skull or brain and sewed up the wound which healed kindly. About two months afterwards the patient became erratic, complained of frontal headache and rapidly developed mania; family history on this point negative. Patient was an inmate of private sanatorium for mental diseases for about two years without improving. The family, then, on advice, consulted Dr. W. W. Keen of Philadelphia, who diagnosed probable fracture at site of injury with cyst due to hæmorrhage. Operation completely verified the diagnosis by the escape of more

than an ounce of serum through the trephine opening, and full recovery of reason.

1. It is probable that immediate explorative incision of the scalp in the region of injury would have revealed a fracture, even though not depressed, and that trephining would have discovered hæmorrhage and permitted its control—thus saving this talented young man two years incarceration in an asylum.
2. Note the possibility of cure in such cases of hæmorrhage by removal of the pressure element as late as two years, with the probability of a still later limit.

CASE III.—J. McM., aged twenty-seven; admitted to the City Hospital July 3, 1904, suffering with what was diagnosed by the interne staff as a simple scalp wound on the left side of forehead near hair line, produced by a blunt instrument; length of wound $\frac{5}{8}$ of an inch. No involvement of bone discovered. An explorative scalp incision not made; wound closed by suture and patient returned to his home. Two days later sutures were removed at the out-patient department of the hospital; union apparently good.

Two weeks later he returned to the dispensary on account of a small abscess in the suture line, which was evacuated and for about ten days dressed in the out-patient department. Meanwhile, no other symptoms developed.

July 30, an ambulance call was sent in for this patient, and he was removed to the hospital, where he remained until his death.

His history, on admission, presented nothing of note until 11 A.M. of that day, when he became moody and refused to talk, in spite of which he ate a hearty dinner. After dinner he went to bed and slept until 6 P.M. On waking he would only mutter incoherently; his gait was unsteady. Upon arrival at hospital his mentality was somewhat better; gave an account of his injury and identified his assailant.

Next morning (July 31) when questioned, he always gave the same answer, namely: "424 Montgomery street"—his residence; some loss of power in right arm; in afternoon dragged right leg. Next day (August 1) right arm and leg completely paralyzed, together with right facial paralysis; choked disc in

right eye; left eye normal; sensation normal. At this time his answer to all questions was "McManus"—his name.

Diagnosis, cerebral abscess in left motor area. Operation advised but refused by relatives, who later, however, consented. Operation performed August 5; patient's condition stuporous, temperature 99.2°; pulse 84; respiration 24.

Usual scalp and bone incisions were made over the line of the fissure of Rolando, the bony opening measuring 2 inches by 1½. The brain pulsated; the dura appeared normal, and without tension. Our belief in the existence of an abscess, however, was so strong that the dura was incised and the brain substance in the underlying motor area explored in various directions by means of a good sized director. No pus found. Much to our surprise, however, on the following day the paralysis disappeared, showing that the operation had relieved tension that had not been appreciable to either sight or touch.

Improvement continued for about one week when paralysis and aphasia returned in the same order as on their first appearance. The general condition, meanwhile, became alarming. It then occurred to me to trephine over the site of injury, in spite of all symptoms pointing to the motor region. The patient's low general condition and the fact that his death would transform the case into one of murder, made me hesitate lest the defense would charge the result on the surgeon instead of the assailant. However, I reopened the wound without anæsthesia, and again used the director without result. Then I decided to take the desperate risk of trephining over the point of injury, ordering preparations for the following morning, but death intervened at 5 A.M.

Autopsy showed no appreciable fracture of the skull, but a small area of adhesion between the dura and cranium, about the size of a silver dime, just beneath the site of injury, also a corresponding adhesion between the meninges and cortex. The convolutions in this neighborhood were prominent, and on incision an abscess containing about 2 ounces of pus was revealed. The abscess was entirely in the frontal lobe but extended well backward and downward toward the motor area. There was evidence of a recent small abscess under the scar of the original scalp wound, a thin layer of purulent material intervening between the scalp and skull.

1. In spite of the non-existence of macroscopic fracture or even fissure, there was in this case transmitted infection, possibly by an emissary vein.

2. Evidence of brain pressure at some interval after skull traumatism is ground for suspecting brain abscess.

3. Pronounced motor symptoms do not necessarily mean that the lesion is in the motor area; they may mean transmitted pressure.

4. A marked peculiarity was that the aphasia was not motor, for he articulated words, but was nearly completely amnesic, for he only remembered his name and address, yet the centres for memory of words and objects are farther from the lesion in this case than the centre for motor aphasia, which exists in the posterior part of the third frontal convolution, the others being in or near the angular gyrus. This must be explained probably by the existence of the association fibres and their probable implication.

5. The presence of brain pulsation and absence of appreciable tension are not always reliable evidence of the absence of abscess or tumor.

6. The choked disc and facial paralysis, as well as the arm and leg paralysis, were on the side of the body opposite to the lesion—a rare occurrence. This may be explained by the action of the commissural fibres.

7. The chief lesson of this case is that paralysis or hemiplegia in a septic traumatic case may mislead one into operating over the motor area, where no lesion may be found. Conversely, always trephine under such circumstances immediately at the site of injury, as the whole trouble may be there.

CASE IV.—T. S., aged forty-eight, transferred to City Hospital from another hospital. He was suffering from alcoholism together with a scalp wound over the right parietal eminence. The wound had turned up a more or less semi-lunar flap, including periosteum, leaving bare a bone surface approximately the size of a silver half dollar.

The patient had been several days in the hospital from which

he had been transferred, and the sutures (if any had been introduced) had either been removed or had cut themselves out, leaving the forementioned exposure of the skull. Examination of this bare area showed no irregularity or sign of injury, unless a mere hair line without depression could be interpreted as a fissure. There was no paralysis and no disturbance of mentality, except such periods of mild restlessness and excitement as are common to alcoholism, for which condition he was placed under treatment. The scalp wound was cleaned up and an antiseptic dressing applied.

This condition lasted about a week, at the end of which time I was absent from the city for a few days. On my return I found that the patient had died. He had suddenly developed left-sided twitchings, rapidly followed by paralysis, on the appearance of which my house surgeon had immediately trephined over the hair-like line on his skull, finding an abscess containing about one ounce of pus. The patient rapidly grew worse and died about forty-eight hours after operation.

Autopsy revealed an abscess cavity under the exposed bone, and also a quite extensive suppurative meningitis, involving the surrounding convolutions.

1. One should always question every suspicious mark on an exposed skull surface in case of traumatism, even if it be no more than a hair line, for this may be a possible fissure and a potential source of infection.

2. Do not pass lightly any evidence of disturbed mentality, such as alcoholism, in the presence of skull traumatism; it may mean either meningitis or abscess; and remember that alcoholism, *per se*, has a sub-normal temperature, while meningitis and brain abscess show temperature elevation.

CASE V.—John A., aged twenty-nine; arrested October 29, 1906, and locked up at the station house as drunk and disorderly. He complained of headache during the night, and was found unconscious in his cell the next morning. Sent to the City Hospital.

Conditions on Admission.—Unconscious; temperature 99°, rectal, pulse very high tension, and slow; respiration 16. A super-

ficial brush wound over the left malar bone; a contusion of the right posterior vault of the cranium near parieto-occipital junction, and three dime-sized spots of ecchymosis on the left arm were all the external evidences of injury to be found. Pupils normal and responsive to light; no paralysis, but slight hypertonicity of muscles. Four ounces of urine obtained by catheter, dark amber, highly acid, sp. gr. 1020; sugar, casts and blood, negative; urea not estimated.

Treatment.—Head shaved and ice cap applied; calomel gr. v and jalap gr. xx administered by mouth; croton oil minims ii and olive oil, one pint, given as a high enæma; pilocarpine, gr. 1/10, hypodermatically, repeated in one hour.

Twelve M., temperature 98.8°; pulse 60, tension lessened; respiration 18; skin moist and warm, free action of bowels; pupils still normal; muscle tonus increased.

Two P.M. Patient yet unconscious, passing bright red blood from bowels; specular examination revealed no source of hæmorrhage; enæma of 1½ ounces. Adrenaline, 1/1000, in one pint of cold saline was given and an ice cap applied to the abdomen without effect; also an enæma of 2 ounces of bismuth subnitrate in a pint of cold saline, with negative result.

Six P.M. Muscle tonus minus; hæmorrhage continuing; temperature 99°; pulse 85 and soft; respiration 20.

Hæmorrhages continued and general condition of collapse deepened until death occurred at 1.25 A.M. the day following his admission.

Post-mortem Findings.—External evidences of injury as already noted. On dissecting up the scalp the right temporal muscle was found infiltrated with blood and a line of fracture 4 inches long was revealed, extending from the right parietal eminence downward and forward to the petrous portion of the right temporal bone, without elevation or depression.

Removal of the calvarium exposed a blood clot 3½ inches in diameter and 1 inch thick at its centre (amounting to about 2½ cubic inches), the posterior branch of the middle meningeal artery having been divided where it crossed the line of fracture. A corresponding depression in the cortex, extended from the margin of the posterior ascending parietal convolution to the cuneus and from the base of the skull to a point 1 inch below the longitudinal fissure.

Opening the abdomen the omentum and peritoneum were found dry and the intestines empty. The large intestine contained unclotted blood throughout its whole length, but no point of ulceration or erosion could be found. The mucosa was injected, blood-stained and showed small spots of submucous hæmorrhage. The liver indicated beginning fatty cirrhosis. Spleen normal. The kidneys were of normal size, capsule stripping easily. The cortex was slightly congested but no pathological condition was evident to inspection. Bladder contained about 8 ounces of urine. Heart and lungs normal. No microscopical examination of kidney tissue was made, consequently the possibility of nephritis was not definitely settled.

1. Here was a case where the different elements of a possible brain traumatism of a serious type, uræmia, or simple alcoholism presented upon admission.

2. The coma would be common to all; but at the time of admission. if due to alcoholism, should have been disappearing. In either of the other conditions it would likely be increasing.

3. Pulse rate and tension might be the same in either brain traumatism or uræmia.

4. Scanty secretion of a highly albuminous urine, together with coma and a high tension pulse, were very suggestive of uræmia, which we are not even now certain did not play a part, because no microscopical examination of the kidneys was made owing to lack of suitable facilities at hospital.

5. There was no external evidence of fractured skull.

6. The clot, although over some parts of the motor area, did not give motor symptoms, because of the existing coma.

7. Had a *local* scalp explorative incision been made no fracture would have been discovered.

8. Had an *extensive* scalp exploration been made the fracture would have been discovered. Trephining and control of hæmorrhage would then have transpired.

9. It is still an open question whether or not this procedure would have saved life. The patient evidently bled to death from intestinal hæmorrhage.

10. The vital question is what caused the continuous and fatal hæmorrhage?

11. Undoubtedly increased tension was an etiologic factor; but was the tension due to brain pressure or nephritis, or in either event would the increased tension for twelve to fifteen hours, have caused hæmorrhage in the normal intestinal mucosa?

12. If early operation is desirable to control hæmorrhage due to fracture of the cranial vault, this case certainly demonstrates the value of *wide explorative incisions and dissection of the scalp*.

Inasmuch as the fracture was not depressed but simply linear and did not approach the point of contusion nearer than 2 inches, nothing less than the reflection of a large flap of scalp would have revealed it. Such a procedure, if aseptic, should be safe, and if findings are negative the patient should be none the worse, while if positive much might be gained.

THE VALUE OF TREPHINING AS A PALLIATIVE MEASURE IN TUMORS OF THE BRAIN.*

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SIR VICTOR HORSLEY, in his address on Surgery, at the meeting of the British Medical Association in Toronto in August, 1906, drew attention to the importance of trephining for the relief of certain symptoms due to intracranial disease and, as my experience with a small number of cases of this kind would fully bear out the opinions expressed by him, I take this opportunity of further emphasizing this subject.

The classical symptoms of tumor of the brain are: Optic neuritis (which usually ends in total blindness); severe headache; and vomiting,—all of which symptoms, being dependent on pressure, can be relieved or entirely removed by a free opening in the skull and dura mater. The most serious symptom of all is, of course, optic neuritis on account of its resulting in blindness: and if there is any means of averting this dreadful calamity it is our duty to employ it. The most important factor in the production of optic neuritis is increase of intracranial tension, and consequently Horsley found that the optic neuritis rapidly subsided after opening the skull and the dura mater. He says that in no case of optic neuritis (excepting those of toxæmic or anæmic origin) should the process be allowed to continue after it has once been diagnosed, and if blindness results therefrom, the responsibility is very heavy upon any one who fails to advise an opening of the dura. It is desirable that the gravity of this responsibility should be generally recognized.

It is usually necessary to make a free opening in the dura

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mater as well as to remove a portion of bone. As to the prediction of the improvement of vision after such procedure everything will depend on the condition of the discs. Yellowish white patches of exudate or white atrophic changes, especially when associated with macular figures, all indicate that the secondary changes in the discs will be permanent. In proportion to this development will the vision be impaired, whereas when the loss of vision has been dependent on the swelling of the discs, then not only is the sight saved but largely improved. In other words, one might say that where the neuritis had not passed on to atrophy the sight would be saved. Horsley states that the optic neuritis commences on the side of the lesion, so that one should be able to judge the side of the lesion by observing which of the nerves is first affected, or, if both are affected, the one which seems to be suffering the greatest changes. The old procedure of de Wecker, of incising the swollen sheath of the optic nerve in the orbit, is of no avail, but Horsley states emphatically that we can with certainty avert blindness by opening the subdural space early, in cases of intracranial disease.

I shall now give the history of some patients with brain tumors upon whom I have recently operated.

CASE I.—Mr. H. C.; age sixty; patient of Dr. Fotheringham. Admitted to the General Hospital September 25, 1906. Complaint: Stupor and muscular weakness of the legs. About two years ago he began to show weakness of the legs and unsteadiness at times. He had a staggering gait to one side—not sure now to which side. Gradually he became bedridden; he was very weak, the legs were paralyzed and his intellect became dull. His condition gradually grew worse until now he is in more or less of a stupor, though he can be roused. His arms are also weak.

Present Condition.—Legs not completely paralyzed; he can move them a very little. Considerable spasticity of legs and arms. No vomiting. Pupils somewhat dilated but equal; double optic neuritis present.

Patient was also seen by Dr. Howland. Diagnosis: Tumor of the brain, thought to be in the right Rolandic area.

October 2.—A piece of the skull over the middle of the right motor area about 3 inches square was removed. The dura was not opened, as it was intended to do the operation in two stages. Patient recovered nicely, and on October 9 the second stage of the operation was proceeded with. The dura was then opened and an exploration made, but no tumor found. There was considerable œdema of the brain substance.

October 12.—Patient gradually became comatose after the operation and died this evening. An autopsy was done and a growth the size of an egg was found in the left lobe of the cerebellum, lying immediately under the pia mater, uncovered by brain substance. On section it was found to be gliosarcoma. The mistake in locating the position of the tumor was probably due to not taking into account the early symptoms, which all pointed to cerebellar tumor. If this case had been diagnosed and operated upon earlier there would have been a good chance of recovery.

CASE II.—Dr. W. T. C.; age forty-eight. Admitted to the Toronto General Hospital August 15, 1906, under the care of Dr. Campbell Meyers. The patient was born in Oxford County and practised medicine in Detroit, Mich., until six weeks ago. Four years ago he felt overworked and gave up practice for a few months. He has been fairly well since, but has felt tired and not up to par. He is a light smoker and uses alcohol sparingly. He has been using a motor car recently but has not felt equal to driving it at night. Never had syphilis or gonorrhœa. He complains of diplopia, pain over the left eye and a feeling of exhaustion. There is no history of nervous disease in the family. About six weeks ago he felt more tired than usual and the pain commenced in his head. He had been treated for unequal pupils. As the pain in his head continued and he felt weak, he went to Cobalt to see some friends and for the change, but the pain in his head became worse—so severe that he could not sleep. He came to Toronto and Dr. Ryerson examined his eyes but could find no cause for the diplopia. Discs were normal.

Present Condition.—He has lost weight lately and looks to be sixty. He is very restless, especially at night, tossing about and moaning and talking. He lies with both eyes shut, but when talking or walking he opens the right eye though never the left unless asked to do so, then very slowly. He is hard to rouse and requires a good deal of shaking to get him up. He walks uncertainly

unless guided, sometimes with the right eye open and sometimes with both closed. It is very hard to get him to talk and he answers questions slowly and in monosyllables and seldom gives a direct answer. He wanders a great deal and apparently cannot concentrate his mind to answer questions put to him. Cerebration is slow. He takes no interest in things going on around him. The pain, he complains, is very intense, being behind and above the left eye; it is worse at night and he has been unable to sleep for nights without morphia. The left pupil is a little dilated and a little larger than the right; both react to light and accommodation for distance. Sight is fairly good in the left eye but not as good as in the right.

On August 24 he was examined by Dr. Putnam of Boston. On this date his superficial reflexes on the left side were abolished, his left Babinski was dorsal, his right plantar, the left knee jerk absent, right slightly exaggerated. All the deep reflexes on the left side were abolished; the left pupil more dilated but reacted slightly to light. He has very little power in his left leg and no power in the left arm. Pulse weak and irregular.

August 25.—Patient dull; at times cannot be roused; has Cheyne-Stokes breathing. Pulse, high tension and irregular. Examination with the ophthalmoscope shows marked swelling of the left disc. Knee jerk, right—absent. Babinski, right—absent. Knee jerk, left—present but slight. Babinski, left—present. No ankle clonus on either side. He has no power in his right arm; twitching at times in the right hand and forearm. Breathing stertorous.

August 27.—Passing fæces and urine involuntarily. Double optic neuritis is present, more marked on the left side; vessels greatly engorged. He was now quite unconscious. He was seen by Drs. Meyers, Scofield and myself and a diagnosis of tumor of the brain made and operation decided upon. This was accordingly proceeded with, the same afternoon at three o'clock. An opening was made over the right Rolandic area with an inch trephine; this was enlarged by saw-cuts, one above and one on either side of the trephine opening, and the intervening bone was removed piecemeal with rongeur forceps, making the opening $2\frac{1}{2}$ inches square. The dura mater was very tense, and, on incising it, a large hernia cerebri immediately formed. Constant irrigation with normal saline (at a temperature in the irrigator

of 110° F.) was kept up during the operation. The pia mater was deeply injected, and the arteries showed plaques of calcareous material. The bleeding points in the pia mater were ligatured with catgut. The scalp was then closed and a dry dressing applied. His pulse remained weak after the operation, and at 10 P.M. he developed marked Cheyne-Stokes breathing and died at 5 A.M. from respiratory failure.

Dr. A. L. Graham did an autopsy and found, on opening the right lateral ventricle by a longitudinal section, a tumor about 5 cm. in diameter, situated posterior to the anterior part of the optic thalamus and in the crus cerebri. The cerebral vessels were congested and hard, the vessels at the base showing evidences of patchy sclerosis. Microscopic section shows it to be a spindle-celled sarcoma.

CASE III.—Mrs. M. F. R.; age forty; patient of Dr. H. J. Hamilton, with whom I saw her in consultation October 14, 1906, when she was suffering excruciating pain in the head, mostly over the right eye. She was in a highly excited and nervous condition, almost maniacal, with a suicidal tendency. There was external strabismus, ptosis and proptosis of the right eye and vomiting. No weakness of the muscles anywhere. Her chief trouble was violent pain in her head of a bursting character, which prevented her from sleeping and which she claimed was driving her crazy. She was very despondent and constantly asked for something to put her out of misery. The present trouble commenced in 1904, was worse in 1905, and has been increasing in severity ever since. She has had some twitching of the right side of her face.

Previous Illnesses.—She had tubercular disease of the skin of her wrist and above the knee, which healed; also had Pott's disease of the spine, which was cured after wearing a jacket.

Present Condition.—She now has pain in the back of her head as well as over the right eye; she is in a highly nervous condition and is fearful of everything. Pulse weak and rapid. Right pupil dilated; has diplopia with right ptosis. Dr. Colin Campbell examined her eyes and reported as follows: The right eye shows paralysis of the third nerve. She can only half open the lid; pupil all but fully dilated and inactive. The optic disc margin and vessels and retina near by are buried in a mass of watery exudate about 5 dioptries high; vessels rather small—

no hæmorrhages. Macula and periphery free of gross changes. *Left eye.*—Muscles normal; active choked disc 3 dioptries high, with small hæmorrhages on it and flakes of white exudate. Veins very full; macula and periphery normal; pupil small and inactive. Nothing would relieve the pain in her head but morphia, and this only slightly when a grain was given hypodermically.

Diagnosis.—Intracranial pressure from one of the following conditions: meningitis with thickening, tubercular or syphilitic tumor. It was decided to trephine in the right frontal region to relieve the pressure. This was done on October 17, 1906.

As soon as the bone was removed the dura bulged into the opening; the dura was incised and a large hernia cerebri developed. The anterior part of the base of the frontal lobe could be seen but there was no evident indication of the nature of the trouble. Some exploration was made of the frontal lobe but nothing discovered. The dura was left open and the skin flap closed except for a small opening for gauze drainage. The wound healed nicely except where left open for drainage, and here there was a considerable discharge of cerebrospinal fluid. She had almost immediate relief from the headache and vomiting. When the opening was allowed to close she had return of the headache and on opening it with a probe and giving vent to the cerebrospinal fluid the headache was immediately relieved. On one occasion when it had closed the House Surgeon was called up at 4 o'clock in the morning, and, finding the small opening closed, opened it with a probe and let out about two ounces of cerebral spinal fluid. The patient had immediate relief and went to sleep.

November 16.—Sees no better. Right ptosis almost nil and pupils semi-dilated; reaction very slight. The right optic disc merely obstructed by exudate. No hæmorrhage and almost no swelling. *Left eye.*—The outer margin of the disc clear; inner margin hidden by piabolic exudate. The disc looks pale but indistinct.

November 27.—Patient was taken home to-day in good condition. Pulse 100, temperature normal. Headaches entirely relieved and is able to take a large mount of nourishment and has no nausea or vomiting. She has required nothing for her pain since the operation. Her general nervous condition is markedly improved; the nervous, excited condition has entirely disappeared. She sleeps from seven to eight hours at night. Since going home

she eats her meals at the table with the family. The ptosis and diplopia have disappeared.

CASE IV.—Miss McC.; age thirty-five; patient of Dr. R. J. Wilson, with whom I saw her on November 10, 1906. She complained of intense pain in her head, most marked over the left occipital region. She taught in a kindergarten school until June last. Had the diseases of childhood and had diphtheria when a child and typhoid since. When she was eight years old she received an injury from the crank of a grinding stone in the left occipital region, which left a small indentation at that spot. In April of this year patient had a sense of dizziness and would lose sight for a moment or two. On one occasion she fell in the street and another time fell down the steps of her boarding house, but without injury, being able to get up immediately and go about as usual. She had the feeling in her head as if she would fall and was constantly holding her hand up to guide herself about the room. She continued to teach in school until June 27, 1906. At this time the pain in her head became so severe that it seemed unbearable. She has lost her sight within the last four weeks, but up to that time she was able to read.

Her condition on entering the hospital on November 12 was as follows: Is very talkative, fairly well nourished, pupils widely dilated. She can distinguish daylight from darkness and she can tell when a hand is passed before her. She has weakness of the external recti; there is some weakness also of the left superior rectus, and internal strabismus of the left eye. The pupils do not react to light or accommodation. She is not able to wrinkle the left side of her forehead or wink the left eye; her tongue is protruded to the left side and when she attempts to blow or whistle the left side of the mouth droops. She has had weakness of the left side of her face for some months. In eating, food would accumulate in the left cheek. The grip of the left hand is weaker than that of the right. She has had considerable vomiting, independent of food. The right knee reflex is exaggerated—left normal. There is loss of the sense of smell in the left nostril and loss of hearing in the left ear.

Dr. Colin Campbell examined her eyes and reported as follows: Eyes staring; right eye the better of the two; left eye converges; outward movement defective; no obvious facial paralysis: Pupils: *right*, slightly smaller; both react sluggishly, espe-

cially the left. Both pupils larger than normal; right, slightly smaller. Double optic neuritis. In the right eye the swelling of the disc is 4 to 6 dioptries high. Veins moderately distended; vessels near the disc varied in exudate. A few small hæmorrhages only; no macular figures. Rest of fundus normal. *Left eye.*—Swelling of disc only 2 dioptries high. The outer margin of the disc almost visible; macula clear. The margins of the disc show white radiating appearance of exudate. It appears to be subsiding.

She was seen by Dr. Campbell Meyers and Dr. W. P. Caven, and they concurred in the diagnosis of tumor of the cerebellum, probably of the left side.

I operated on November 14, trephining over the left cerebellum. The dura mater bulged into the wound. The trephine opening was enlarged $\frac{1}{4}$ inch on either side and the dura incised. The cerebellum immediately projected out through the opening in the dura to a distance of $\frac{1}{2}$ inch above the surface of the bone. The cerebellum over an area the size of a twenty-five-cent piece looked injected and infiltrated. On feeling this projecting portion one could make out distinct fluctuation. Cerebellar tissue was separated a little, exposing a grayish membrane, through which a director was passed and from 2 to 3 ounces of clear fluid removed. A pair of artery forceps were passed along the groove of the director and the opening enlarged, when a distinct cyst with thickened walls could be made out. Normal saline at a temperature of 120° was kept constantly running over the wound during the operation. After evacuating the fluid the cyst collapsed and the cerebellum receded, leaving a distinct depression. An opening was left in the dura to allow of a small strip of sterile gauze being inserted for drainage, and the wound closed except where this was brought out.

November 14—Evening.—She has rested fairly well since operation. The pain in her head has almost entirely disappeared.

November 15.—Patient had a good night; pupils slightly active to light but not to accommodation. Patient is able to distinguish dark from light colors and able to count fingers. Dressing done; there was considerable oozing of clear fluid and blood.

November 16.—The pain in her head has entirely disappeared. Had a little soreness between the scapulæ; she is able to recognize odors through the left nasal orifice, oil of wintergreen

being placed on a wipe while the right orifice was closed; hearing in the left ear somewhat improved. Packing removed from wound.

November 17.—Had a good night—no pain or headache is felt and no vomiting. A tube was put in for drainage to replace gauze. Movement of the eyes much improved. Patient complains of hyperæsthesia of left side of face; tongue can now be protruded without deviation to the left; pupils quite active and sight much better. She can recognize the faces of those about her.

November 19.—Hyperæsthesia has about disappeared; patient can wink the left eye and wrinkle her forehead; pupils active; great deal of oozing of straw-colored fluid from wound.

November 20.—Wound healed entirely by first intention, except for the small opening left to provide drainage.

November 29.—Patient able to read the headline of a newspaper; able to distinguish house surgeons, nurses and friends. Can distinguish colors.

December 1.—Can see the snow flakes falling against the window. The discharge of clear fluid diminishing.

December 2.—Patient out in a wheel chair; is quite steady—no dizziness; no pain; eyesight steadily improving. She feels perfectly well. Can recognize people entering the door of her ward.

CASE V.—S. F.; age ten; patient of Dr. Eadie. I saw him in consultation with Drs. Eadie and W. P. Caven on November 23, 1906. He was quite well until last March, when he commenced to have what his parents thought to be bilious attacks once a week. These attacks consisted chiefly of bad headaches, and during this time he would not eat. During August and September he was at Jackson's Point. His father consulted Dr. Eadie in the first part of August, and Dr. Eadie first saw the patient October 1, 1906. His attacks were becoming more frequent and more severe and for the last month he had had three attacks in a week. Once a week the attack was a very severe one. The headache complained of was general. The patient said he felt it all over his head. His temperature was taken every morning for some weeks and found to be normal. He has vomited altogether seven or eight times during the attacks. He has lately been having them every second day, waking in the morning with severe headache.

In the middle of October Dr. Duncan examined his eyes and found double optic neuritis. We had Dr. Duncan examine the eyes again on November 26 to see if he could determine which eye was first affected, so that we might have some guide as to the side of the tumor, and he reports that there is no difference in the discs of the two eyes to indicate which one was first affected. The papillitis has not progressed. He has absolutely no localizing symptoms. Examination of the heart, kidneys, lungs, etc., negative. He has been an exceptionally healthy boy since birth, not having the usual children's sicknesses.

Diagnosis.—Increased intracranial pressure, probably due to tumor. We concurred in advising trephining for the relief of pressure, hoping to relieve the headaches and prevent the optic neuritis progressing to blindness. This was agreed to and the operation was accordingly performed November 28, 1906. Dr. McMahon gave chloroform; Dr. Eadie assisted me. As there were no localizing symptoms, trephining was done in the right temporal region, an area of bone 2 inches square being removed. The dura mater was very tense and on opening it a large hernia cerebri immediately formed. The brain was explored in several directions to a depth of a couple of inches but nothing was found. The dura was left open and the scalp closed without drainage and a dressing applied. As soon as the effects of the anæsthetic passed off he was quite comfortable. He has been quite free from pain and vomiting since the operation. The wound was healed by first intention; temperature and pulse are both normal, and he has made a rapid and satisfactory recovery.

These cases would indicate, in the first place, how important it is that they should be submitted to surgical treatment early, and, secondly, what good results can be obtained by the very safe and simple procedure of trephining.

THE OPERATIONS FOR NEOPLASMS OF THE TONGUE.*

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A BRIEF historical review of the different typical operations and a short description of each will aid greatly in the selection of a method which may be suitable for any given case. Although "cutting off the tongue" was a favorite punishment which in ancient times seems not to have been attended by any great degree of mortality, operators were very slow to take the hint it gave, and the fear of hæmorrhage retarded the progress of the surgery of this organ until only about twenty or thirty years ago. The *ecraseur* or some similar plan of constriction was for a long time the favorite means of attack in all instances demanding interference, and even now there are conceivable circumstances in which this method might be justifiable, as in certain *angeiomatous* conditions. Hence on this account, as well as for historical completeness, the means at our disposal for compressing the base of the tongue should be at least mentioned.

The avenues of approach for removing the whole or a portion of the organ may be classified as through (1) the mouth; (2) the jaw; or (3) the neck. There are occasional references to extirpation of new growths in the tongue through the mouth during the XVII and XVIII centuries, and Marchetti of Padua in 1664 was apparently the first to thus remove a carcinoma.⁴² Inglis, in 1805, in a case of tumor on the border of the tongue, passed several ligatures through the tissues surrounding it, and by tightening them caused the tumor to slough out and thus obtained a cure in the course of three or four weeks. The elastic ligature seems to have been used

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about 1850, and Langenbuch ²⁴ in 1878 advised the application of this principle as a preliminary to the removal of certain angiomas. After drawing the tongue well out and, if necessary, dislocating the jaw forward, a large curved needle carrying a stout silk ligature is entered as far back as possible in the dorsum just to one side of the median line. This passes through the tongue substance, under the lingual vessels, enters the mouth between the jaw and the tongue and again penetrates the edge of the tongue. Another ligature is similarly passed through the opposite side, overlapping the first in such a way that when both ligatures are tied all the vessels and the whole substance of the tongue except its edges are constricted. (Fig. 1.) The disease is then removed with knife or cautery.

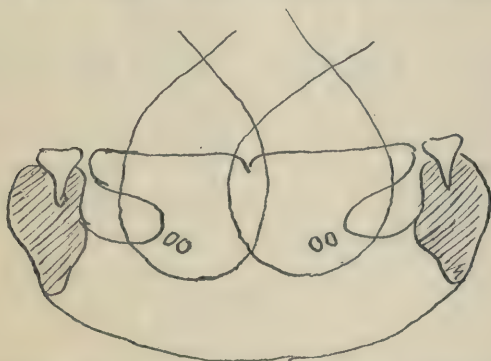


FIG. 1.—Langenbeck's method of constricting the tongue by sutures passed through its substance.

The chain, or wire, ecraseur introduced by Chassaignac in 1854, as stated previously, was once quite extensively used and was passed around or through the tongue and sometimes several were applied simultaneously. Middeldorpf, about 1860, was thought to have slightly improved the instrument by making of it a galvano-cautery; but the hæmorrhage, both primary and secondary, which it was principally designed to control, occurred frequently enough to cause its eventual abandonment. In the elaboration of preventive hæmostasis Cloquet, in 1827, was probably the first to surround the base of the tongue by a ligature entered through the neck. He introduced a needle

carrying a stout suture in the middle line just below the hyoid bone, and brought it out in the pharynx between the tongue and angle of the jaw. It was similarly passed on the other side and the ligature was drawn tightly and knotted on the surface of the neck. Arnott, in 1838, made the procedure more exact by a preliminary vertical incision through the skin and mylohyoid muscle, and Nuneley,³¹ in 1861, gained some reputation by employing this route for applying Chassaignac's *ecraseur*. To prevent the ligature, wire, or chain from slipping forward, knitting needles have been passed through the tongue back of the growth while the mouth is widely distended, or as Barwell,² in 1879, suggested, long steel needles have been similarly passed up from below through the opening made for the *ecraseur* above the hyoid. Fiorani,¹⁵ in 1882, pushed a trochar and cannula from a slit in the skin just above the hyoid bone into the pharynx far back between the tongue and tonsil, first on one side and then on the other and after withdrawing the trochar introduced a silk ligature. The intraoral ends were then drawn out of the mouth and knotted and then slipped back after withdrawing the cannula. And by attaching a stout rubber band to one cervical end of the ligature an elastic tourniquet was thus dragged in and made to surround the vessels at the base of the tongue and tightened by a clamp under the chin.

The credit for recommending preliminary ligation of the lingual artery through the neck above the hyoid bone has been ascribed to Mirault,²⁹ in 1833, or to Roser³⁴ or Roux³⁵ in 1839; and Maissoneuve²⁷ was probably the first to extend this in urging the preliminary exposure and ligation of the external or even the common carotid for extensive operations. It is interesting to note that this procedure about the same time was much advocated for purposes of starving out the growth, and there is occasional mention before 1860 of its usefulness for removing secondary enlarged cervical glands.

Although there are several earlier instances of excision of lingual neoplasms with the cautery, C. J. M. Langenbeck,²² in 1819, seems to have been the first to record the clean removal

of a tumor of the tongue through the mouth by a V-shaped incision around it and immediate suture of the resulting wound. This method was afterwards practised and recommended by Dieffenbach,¹³ who as a preliminary to the incisions, inserted sutures to insure immediate coaptation of the cut surfaces and so obtain hæmostasis. Excision with the knife or scissors was thus in use long before the operation was popularized under the name of its more recent advocate Whitehead,⁴¹ who proceeds as follows: The patient is anæsthetized in a sitting position in a "rocking" chair; the mouth is held widely open with a suitable gag, and the tongue drawn out by a stout ligature passed through its tip. Using only scissors curved on the flat, the frenum is cut and then the mucous membrane along the base of the tongue on one or both sides according to the amount of the organ to be removed. If the diseased portion is not then sufficiently accessible, one or both anterior pillars of the fauces with the underlying styloglossus muscles are divided. If only half the tongue is to be removed it is then split in the median line and cut across about three-quarters of an inch behind the disease. If the whole tongue is to be excised a ligature is first passed through its substance in front of the glossoepiglottic fold (to prevent the stump slipping back out of sight) and the section made anterior to this point.

Originally he recommended that the vessels be seized and twisted as they were cut, and no ligatures seem to have been applied; but later he advised that after section of the mucous membrane at the side of the tongue, the vessels should be isolated by blunt dissection and seized with forceps before cutting. He has always strenuously objected to division of the jaw and to preliminary tracheotomy, and for the latter deserves great credit. Apparently he only removed the cervical glands when they were palpable, and generally at a later operation.

Jacobson¹⁸ uses this method whenever it is possible thus to make the section one inch beyond all disease, and he removes the glands first, if it is necessary to perform the operation in two stages. When only one half of the tongue has to be

excised he passes a ligature through each side of the tip and splits it down the middle and then cuts the mucous membrane along the floor of the mouth on the diseased side, the corresponding anterior pillar of the fauces and the thick mucous membrane on the sides and dorsum of the tongue an inch back of the tumor. After these steps the vessels are isolated in the soft muscular tissue by blunt dissection and seized and ligated before completing the section. Cathcart ⁶ has improved upon this method of hæmostasis as follows: A traction ligature is passed through each half of the tip of the tongue; the mucous

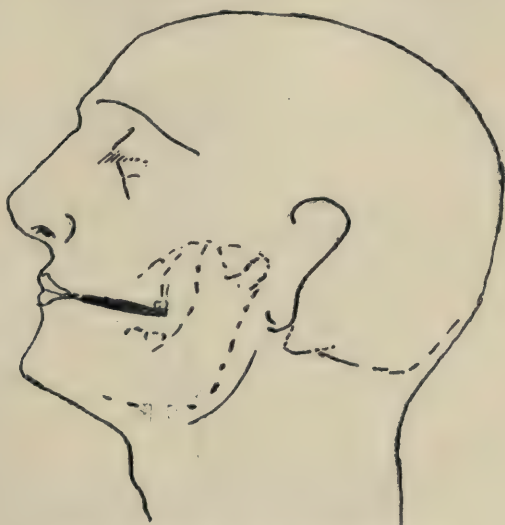


FIG. 2.—Jaeger's method by splitting the cheek.

membrane is then split mesially with straight, blunt-pointed scissors throughout the whole length of the dorsum, and under the tip into the frenum and along the base of the tongue on the diseased side between the tongue and jaw. The geniohyoglossus muscle on the affected side is then defined and its attachment to the symphysis cut, allowing the corresponding half of the tongue to be still more drawn out. The anterior border of the hyoglossus on this side is defined by a director which is passed beneath it, and on this the anterior two-thirds

of the muscle is cut transversely, exposing the artery pulsating at the bottom of the wound, where it is seized and tied and the diseased half of the tongue excised.

In 1832 M. Jaeger¹⁹ (Fig. 2), to gain better access to the back of the tongue, advised splitting one cheek outward to the anterior border of the masseter muscle on a line drawn from the angle of the mouth to the base of the mastoid process. This avoids the parotid duct and generally all important branches of the facial nerve. Maissonneuve²⁷ in 1852 carried out this plan on both sides of the face, and though it has occasionally been employed since then the gain in space is not enough to make the method often useful.

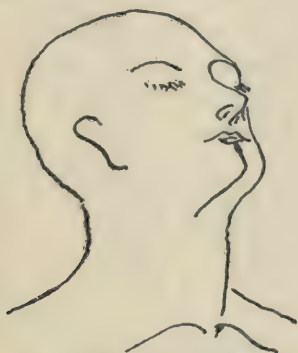


FIG. 3.—Sedillot's incision.

As the operations through the mouth should always be accompanied by removal of the cervical lymphatics some mention should be made here of the possible methods for exposing these structures. Their removal in one mass with the attached fat and fascia from the sternum to the base of the skull together with the submaxillary and sublingual salivary glands, as these constantly contain lymphatics connected with the rest of the system, is theoretically best for permanent cures but not best for all individuals. More surgeons will agree to a complete removal of all dangerous tissue on one side than on both sides, and it may only be necessary to remove the lymphatics and the submaxillary and sublingual glands between the jaw, hyoid bone, and mastoid process. For exposing these there are the

usual straight incisions along the anterior border of the sternomastoid muscle, with liberating ones passing to the chin at a right angle, or the disfiguring S-shaped incision formerly suggested by Hartley¹⁶ or that of Stieda³⁸ following the lower border of the jaw, or the H-shaped incision of Eisendrath.¹⁴ If the operation has to be done in two stages it seems generally wiser to remove the primary disease in the first sitting and the lymphatics in the second.

The first recorded section of the jaw for removal of the tongue seems to have been performed by Roux in 1836,³⁵ who divided the lower lip vertically in the median line and the underlying symphysis. This operation generally goes under

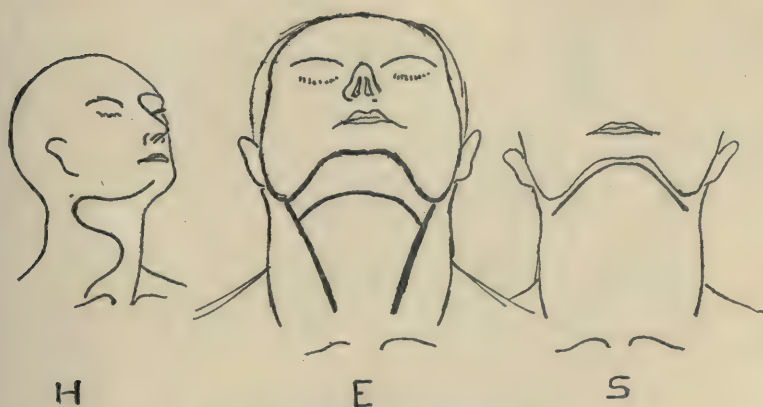


FIG. 4.—Incisions for removing lymphatics.
H. Hartley. E. Eisendrath. S. Stieda.

the name of Sedillot's, who apparently without knowing of his predecessor or at least without referring to him, in 1844 did practically the same thing making a > shaped section at the symphysis. In England the operation was known as Syme's,³⁹ as he introduced the method in 1856 also without reference to previous surgeons, but employed a vertical section at the symphysis with an incision extending in the middle line through the edge of the lip to the hyoid bone. This operation at first was attended by a very high immediate and secondary mortality, both on account of the extent of the disease requiring the

procedure and the subsequent difficulty in deglutition. Langenbeck (Fig. 5) in 1875, improved on this method by dividing the jaw on the diseased side just in front of the last molar tooth from behind forward and from within outward, after first boring holes in the jaw on each side of the proposed line of section. The skin incision extends in a straight or slightly curved line from the angle of the mouth to the sternomastoid muscle at the level of the thyroid cartilage; and the dissection begins from below. The lymphatics and submaxillary gland

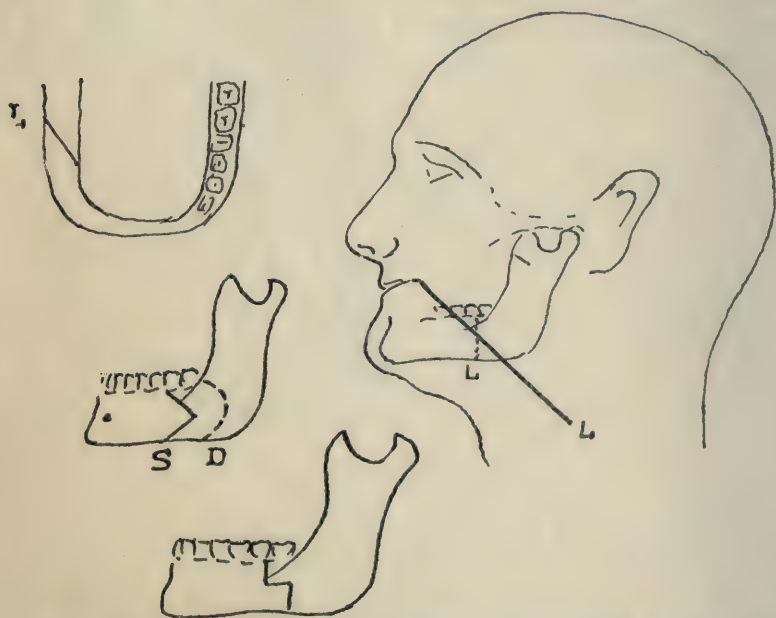



FIG. 5.—Langenbeck's operation (*L, L, L*). Sedillot's method of cutting the jaw (*S*). Downes' method of cutting the jaw (*D*).

are removed, the digastric and stylohyoid muscles and generally the hypoglossal nerve are cut, and in the original method the lingual artery is tied, although a preliminary ligation temporary or permanent, of the external carotid makes the operation shorter and so safer. After cutting the jaw the tongue is drawn out through the wound by a ligature in its tip and as much as need be excised together with one or both

lingual nerves. The raw surface within the mouth is then closed by sutures as far as possible and the jaw is united by wires or silk sutures passed through the holes bored before it was divided. A partial suture of the external wound, with drainage in its lower angle extending into the mouth, follows. Of all the methods this probably gives the freest and most satisfactory access to extensive disease or that located in the posterior portion of the mouth; but it of course results in paralysis of half of the lower lip, and to avoid this Crespi and Bastianelli³ (Fig. 6) in 1890 made an angular shaped  incision vertically through the middle of the lower lip, then

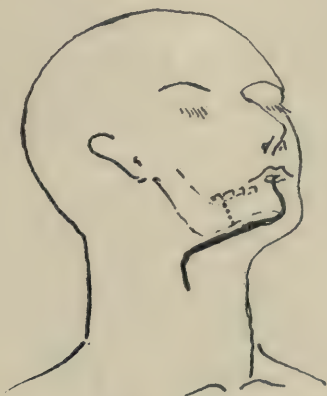


FIG. 6.—Bastianelli's incision.

along the inferior border of the jaw to the sternomastoid and down that over the great vessels as far as need be. The skin and soft parts are raised to about 2 cm. in front of the masseter, exposing nearly all of the lower jaw, which is sawed through as in the original Langenbeck operation, in front of the last molar tooth or at any desirable point.

Kuster,²¹ in 1885, combined Langenbeck's skin incision with Mikulicz's method of pharyngotomy, by excision of the ascending ramus of the jaw, and in instances where the disease involves this part of the bone or the attached soft parts it presents advantages. The original Mikulicz pharyngotomy (Fig. 7) was undertaken for removing a cancer of the tonsil,

and also gives moderately free access to the glosso-epiglottic region of one side. The incision extends from the base of the mastoid process downward for about three inches along the anterior border of the sternomastoid muscle. Through this the soft parts are raised from the inner and outer surface of the ascending ramus of the jaw with a periosteal elevator, the mouth entered opposite the last molar tooth and the bone sawed through at the angle. The upper anterior portion of the wound with the overlying parotid gland is drawn forward and the ramus backward, while the insertion of the temporal muscle is separated with the knife, or the coronoid process is cut through at its base with forceps. Then the ramus, aided by a few snips with scissors, is twisted or torn out of the joint. Aided by a finger or urethral sound in the pharynx, the latter is opened after dividing the digastric and stylohyoid muscles in front of the carotids, and above the superior laryngeal nerve, which should be spared.

Minor modifications can be made of Bastianelli's³ incision, such as prolonging the wound in the lips to and along the hyoid bone, for the removal of secondary deposits, or placing it on one or the other side of the mental foramen to adapt the flaps so as to expose any secondary or extensive growth and preserve as much as possible of the motor and sensory nerve supply of the face. Czerny¹¹ has thus combined Jaeger's and Langenbeck's methods by splitting the angle of the mouth backward to the masseter muscle and then carrying the incision vertically downward through the soft parts and the bone to the thyroid cartilage, but only in exceptional instances would such an opening be necessary. In another case median division of the lower lips and chin, with a prolongation of the incision, as in Kocher's operation, was accompanied by removal with the lingual disease of the entire corresponding half of the lower jaw. Rose³³ in 1900 thus successfully removed the tongue and all the soft parts in the floor of the mouth down to the hyoid bone, and the entire lower jaw with the exception of one ramus and enough of the attached body to permit the retention of the corresponding two posterior

molar teeth. The patient a year afterwards was in good condition and showed no recurrence. Also Kocher in 1890 combined in one case his usual incision with a prolongation downwards along the sternomastoid and section of the jaw at the angle.

The only osteoplastic method which has been recommended is known as Billroth's (Fig. 7) and was described in 1862. A vertical incision is made from each angle of the mouth to below the lower border of the jaw, which is then sawn

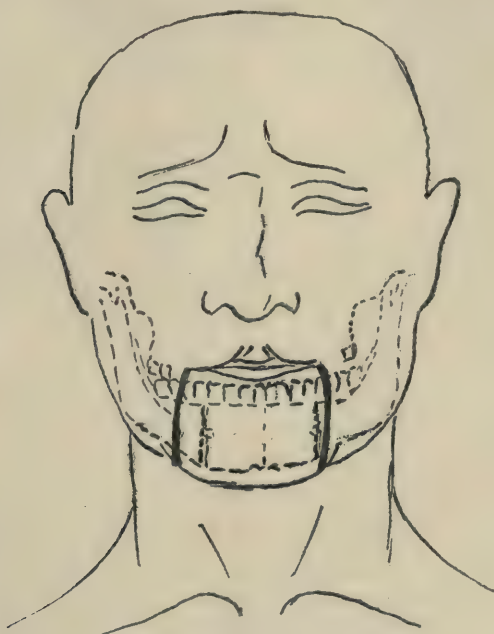


FIG. 7.—Billroth's osteoplastic method.

through on these lines and the chin with the attached soft parts then displaced downward. After removal of the disease the bone is replaced and held in position by sutures.

The manner in which the jaw is cut and afterwards united is of considerable importance. In the earlier methods a straight transverse, a < shaped or \neg angular division was made with the saw directed in different planes for each angle with the object of avoiding displacement, but the geometrical law that

the intersection of all plane surfaces is a straight line prevails and displacement cannot thus be escaped. In division near the angle the posterior segment, under the influence of the pterygoid muscles tends to be drawn inward and division from behind forward and within outward, thus making the posterior overlap the anterior segment, is best. In this region also a C shaped (as suggested by Dr. Downes of this city) or < shaped section helps to minimize the tendency to upward and downward variation. But with any saw, and especially the Gigli wire instrument, there is considerable loss of tissue which increases the difficulties of adjustment; possibly the use of giant bone forceps, as suggested by one of the English surgeons,

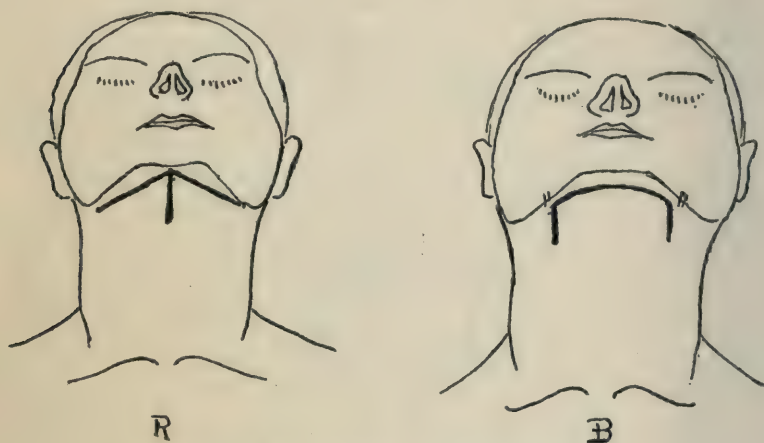


FIG. 8.—R, Regnoli's operation. B, Billroth's modification.

would leave the closest-fitting joint. In reuniting the segments the preference is generally given to silver wire sutures passed through holes bored on each side of the line of section before the latter has been completed. It is very difficult to bore them afterwards. And two sutures assure better retention than one. Petersen,³² in 1887, advised fastening the segments (sawn so as to overlap) with silver nails driven through the cheek, though in old people, owing to the danger of fracture, holes should previously be drilled. Dr. K. C. Gibson, the dentist who has had the most experience with interdental

splints, informs me that he advises against such appliances in these cases on account of the difficulty of maintaining cleanliness; but in cases requiring more or less extensive removal of the jaw some prosthetic apparatus should be worn for about a couple of weeks to prevent bad displacement of the remaining segments.

The earliest of the operations upon the tongue by the route below the jaw or through the neck is known as Regnoli's³⁶ (Fig. 8, R) (published in 1838) whose Λ shaped incision began opposite the symphysis and followed the lower border of the jaw to the angles and was supplemented by a median division of this flap. Billroth (Fig. 8, B) in 1874 modified this by an incision of 3 to 4 cm. following the lower border of the jaw, with its centre opposite the symphysis and its extremities just avoiding the facial arteries. From each end of this, straight liberating incisions were carried backward and downward to the greater cornua of the hyoid bone. After division of the attachments of the digastric and mylohyoid muscles, the inner surface of the concavity of the jaw and the genial tubercles were freed of soft parts by the periosteal elevator, the floor of the mouth entered and the tongue drawn out on the neck and as much as need be excised. Owing to the complete division chiefly of the geniohyoid and geniohyoglossus muscles the subsequent difficulties in deglutition and breathing seem to have been considerable and were apparently the principal factors in the high mortality of 25 or 30 per cent. in this operation.

Czerny (Fig. 9, Z) in 1870 was apparently the first to advise the lateral inframaxillary route. His incision extended from the symphysis to the middle of the hyoid bone and then along its upper border to the edge of the sternomastoid muscle. Through this opening the lingual artery was tied in its triangle, the skin and platysma were dissected up to the jaw from the inner surface of which the periosteum and attached soft parts were raised by a periosteal elevator, from the angle to the symphysis, until the mucous membrane was reached and divided close to the teeth. Then the anterior attachments of the geniohyoid and geniohyoglossus were sev-

ered and the tongue drawn out on the neck. At the same time with the primary disease the sublingual and submaxillary salivary and lymphatic glands of one side could thus be removed. Kocher's operation (Fig. 8, K), published in 1880, differed from this slightly in the external incision which extended along the anterior belly of the digastric from the symphysis to the hyoid, following its upper border to the sternomastoid and then upward to a point opposite the mastoid process. The flap was raised, exposing the muscles; the submaxillary and sublingual glands were then excised, the vessels tied in the lingual triangle, the mylohyoid cut close to the jaw and the tongue drawn

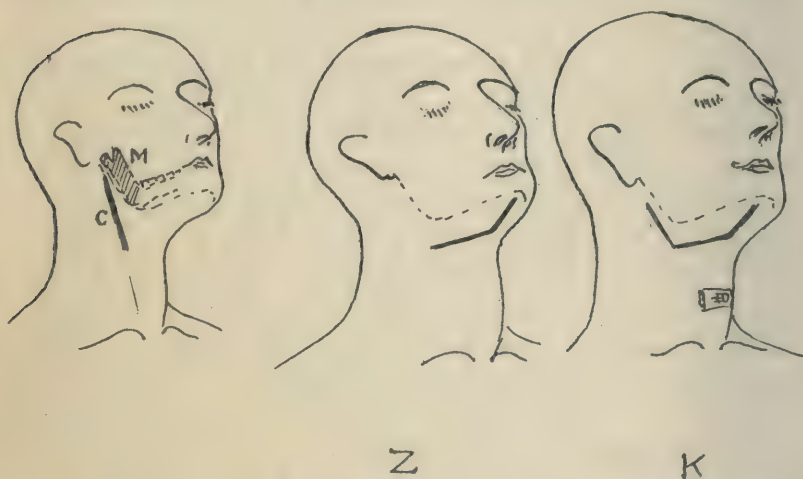


FIG. 9.—C, M, Mikulicz method of pharyngotomy with excision of ascending ramus of jaw. C, Cheever's incision for pharyngotomy. Z, Czerny's inframaxillary operation. K, Kocher's operation with preliminary tracheotomy.

below out of the wound, without interfering with the muscular attachments to the genial tubercles. After free excision of the disease the wound was partially closed and packed. The chief feature of the procedure was, however, the preliminary tracheotomy and tamponade of the pharynx and trachea to prevent the septic pneumonia which was always the most frequent cause of death. He thus presented a series of cases with a 7 per cent. mortality instead of the usual 20 or 30 per cent.,

which had been the experience of others, and his methods thereafter were widely adopted.

Cheever's lateral pharyngotomy (Fig. 9, C) introduced in 1869, does not give as free access to the back and base of the tongue as Mikulicz's operation, but it is less mutilating and might occasionally be useful. A three or four inch incision is carried downward from the base of the mastoid process along the anterior border of the sternomastoid and through this, after division of the digastric and stylohyoid muscles, the pharynx is entered in front of the vessels and above the superior laryngeal nerve.

Subhyoid pharyngotomy by transverse division of all soft parts in this situation could not be as useful as the corresponding suprahyoid operation and neither operation gives as satisfactory access to the rare benign growths of the base of the tongue, for which alone such an approach is justifiable, as Vallas⁴⁰ transhyoid pharyngotomy described in 1900. In this an incision is carried from the symphysis to the pomum Adami, the hyoid cut in the centre with bone forceps and the wound deepened, if necessary, through or to one side of the epiglottis until the pharynx is opened; or previous to the section of the hyoid, Kocher's flaps are raised on one or both sides and, after ligation of the vessels in the lingual triangle and extirpation of the glands, these lateral incisions are closed, the bone cut and the pharynx then opened and the primary disease in the tongue thus exposed and removed.

It has generally been customary to close by suture all the raw surface possible which may be exposed within the mouth and Lane,²⁵ in 1892, advised the formation of flaps of the remaining sound mucous membrane to facilitate this, and the turning of the tip of the tongue if present, around into any lateral gap.

As a palliative operation for the relief of pain Hilton,¹⁷ in 1850, was the first to introduce section of the gustatory nerve in the floor of the mouth between the tongue and second molar tooth. By knicking the mucous membrane and a little blunt dissection, it can be found here just behind the sublingual

gland; or, better, after the method of Moore;³⁰ the tip of the tongue is drawn well out of the mouth toward the opposite side and the nerve cut just below the mucous membrane by a three-fourths-of-an-inch incision on the line passing from the crown of the last molar tooth to the angle of the jaw. The edge of a sickle-shaped knife, to reach under the mylohyoid ridge, is directed toward the bone.

In all these different methods, and at all times pneumonia, shock, hæmorrhage and sepsis, about in this order, seem to have been the most frequent cause of an immediate mortality which has gradually decreased from between 30 and 40 per cent. to between 5 and 15 per cent., depending upon the extent and duration of the disease and the severity of the operation necessary for its removal. Death from the recurrence of cancer has generally been produced by its growth in neighboring lymphatics, or diffusely in the wound made for the original removal of the disease, less often in the stump of the tongue and rarely from metastases in distant organs. The percentage of permanent cures has varied in different statistics from 10 per cent. to 30 or 40 per cent., and seems on the average to be nearer the former than the latter figures. But so many factors have to be considered that one can only say there are enough chances of success to make all but the clearly hopeless cases worthy of trial.

As regards the mortality following the different operations the statistics are naturally greatly in favor of those I have described as Whitehead's, coupled with thorough removal of the cervical glands. And it is decidedly worthy of note that in these cases usually only a portion and not the whole tongue has been removed. This implies, of course, that patients treated by excision of the disease through the mouth must usually have presented themselves at an early stage, but it by no means covers all such operations performed by the English surgeons, who seem seldom to use any other method and whose results compare very favorably with the commonly more drastic and mutilating procedures of the Germans. When, therefore, the line of excision can be made at least

three-quarters of an inch wide of the growth, through sound tissues by Whitehead's method, experience has apparently proved it the best both for immediate and late mortality. Jaeger's plan of splitting the cheek outward, as remarked previously, increases only to a slight degree the amount of space offered by the natural opening, and as it adds an unsightly cicatrix and some risk of auto-innoculation of the wound and more or less facial paralysis, it is not to be generally recommended, although for some unusual case it might be of service and so should not be forgotten.

Before passing from the operations through the mouth to those which can only be carried out by other methods, some reference should be made to the amount of the tongue which it is necessary to remove for malignant disease and the advisability of excising the latter where there is a considerable or deep involvement of the anterior part of the floor of the mouth. It seems to be the general practice in Whitehead's, as in other operations, even when the disease involves only a portion of the lateral border, to begin at the tip of the tongue and cut through the middle line to a point about three-quarters of an inch behind the growth, and this is also done when the tumor is well back of the anterior extremity of the organ. I can find no good anatomical reason for this, as the lymphatics do not run forward but downward or backward, and although the exact line of section is not generally described, the results, as regards local recurrence, appear to be equally as good when the lateral disease is excised by a simple V widely around the sides of the neoplasm as when the whole of the organ is removed. Hence, as the tip of the tongue is very necessary for speech and for mastication, it should be spared whenever it is not within at least half an inch of the new growth, or it may be partially turned back for plastic closure of a large lateral defect.

The advisability of operating upon a cancer which involves the anterior attachments of both geniohyoid and geniohyoglossus muscles needs much consideration. Pneumonia is and has been the most frequent cause of death in all operations upon

the tongue, and while formerly the aspiration of blood was thought to be the chief etiological factor, it has of late been generally conceded that interference with deglutition is far more important in this respect, and that while exhaustion from shock and hæmorrhage can predispose to this dangerous intercurrent affection, any additional burden upon the act of swallowing makes the chances of an attack of pneumonia greater. The fatalities due to this disease caused the abandonment of Billroth's osteoplastic method of resection of the anterior segment of the jaw and finally of his and Regnoli's submental operations and the general adoption of the lateral operations, or of Whitehead's (all of which usually leave intact at least one geniohyoid and part of one geniohyoglossus muscle), has been followed by a great improvement in the pneumonia mortality. Hence it is apparent that operations which involve separation of all the muscular attachments from the genial tubercles present a grave prognosis, and the subsequent difficulties dependent upon breathing and swallowing may be so great as to seriously raise the question whether or not such a procedure is justifiable. Personally I believe that it is seldom proper.

For cases in which the disease is located far back in the mouth or in which one or other pillar of the fauces or the tonsil or pharynx is involved, Langenbeck's operation, or more rarely Sedillot's, is the one of choice. These methods not only leave undisturbed the muscular attachments to one or both genial tubercles but they both, especially Langenbeck's, provide very free access for operations in the oral cavity, and at the same time expose the cervical glands and the great vessels. It has been my experience that not only is preliminary ligation of the external carotid simpler and therefore more quickly carried out than ligation of the lingual but it is equally safe and far more effective in facilitating all the steps in the rather extensive interference in these more difficult cases. The operations through the neck, such as Billroth advocated, have practically been abandoned for the reasons stated above, and Kocher's lateral inframaxillary route with its attendant preliminary tracheotomy, once so popular, is now seldom practised—and

for several reasons, one of which at least I have not observed to be noted in the literature as a valid objection. This is the liability to recurrence of the cancerous elements diffusely in the line of the cicatrix. Kocher's incision provides so little space that the force necessary to drag the tongue down within reach through the cervical opening involves considerable risk of auto-inoculation of the wound, if the epithelioma, as is usual, is an open ulcer. And in former days, when the operation was more frequently employed than at present, I have several times observed this occurrence. Auto-infection of a fresh wound with malignant disease is an ever present possibility in all operations, especially in those upon the head and neck, and ought to be more emphasized than it is.

The frequently fatal pneumonia which was and often now is attributed to the aspiration of blood into the lungs, must be ascribed chiefly to difficulties in deglutition, though hæmorrhage with its attendant shock and prostration is undoubtedly a contributory factor. Hence preliminary tracheotomy with the attendant tamponade of the trachea and pharynx, should generally be avoided as it contributes only its own additional dangers and increases the patient's difficulty in swallowing, and general discomfort. A thorough preliminary hæmostasis by permanent or temporary occlusion of the external or even the common carotid, as Crile advises, is far more rational. If, however, there is dread of foreign matter entering the larynx during the operation, an O'Dwyer laryngeal catheter or Crile's rubber tube instrument is an efficient substitute for the more dangerous tracheal cannula.

In conclusion a word should be said about the after-treatment, or rather the preparatory treatment, of these patients whose nutrition is apt to be so badly impaired; many of them, especially if the jaw has had to be divided, have great difficulty in taking nourishment, and feeding by a stomach tube during the first week of convalescence is absolutely essential. If before the operation is undertaken the individual for a few days is habituated to lavage and goes through a course of mouth and tooth cleansing, the subsequent chances of safety and comfort are greatly increased.

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A METHOD OF USING THE TONGUE IN SUPPLYING A DEFECT OF THE CHEEK.

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It is generally admitted to be very difficult to close an extensive gap in the cheek by any sort of a plastic which contemplates the use of the tissues of the face. The principal difficulty lies in completely clothing the interior with mucous membrane.

But recently I hit upon a plan of accomplishing the desired end with surprisingly little difficulty, even though I had sacrificed practically all the mucous membrane between the upper and lower alveolar processes on one side. The idea is so simple, and the means of relief in such a case lie so near at hand, that I was greatly surprised to find nothing of the same kind readily accessible in the literature of the subject.

The patient was a well preserved man of seventy-one. A year previous to the time that I first saw him, which was December 6, 1906, a sore appeared on the inner surface of the left cheek, he supposing the same to be due to the mucous membrane having been scratched by a tooth. Six weeks before he came to me, what he speaks of as a sore, appeared on the outer surface of the same cheek exactly opposite the interior lesion to which reference has just been made. By the time I saw him these symmetrical lesions were each of them about the size of a quarter, located, as has been mentioned, one of them on the skin, and the other on the mucous membrane of the left cheek, midway of the alveolar processes and about 1 cm. from each of these. The edges of the lesions were elevated, indurated and their bases were semi-necrotic. Evidently the process was carcinomatous.

On December 7, 1906, a circular incision about $\frac{1}{2}$ cm. away from the diseased tissue, and completely encircling the growth, was made through the entire thickness of the cheek. The result-

ing defect appeared surprisingly large in view of the elasticity and consequent natural retraction of the tissue involved. It was, of course, impossible to bring the mucous membrane edges together, in view of their firm attachment to the alveoli, not more than $\frac{1}{2}$ cm. away. Confronted by this state of affairs, I made a deep horizontal incision into the side of the tongue, practically separating half of the member into two flaps, an upper and a lower. The edge of the upper flap was sutured with catgut to the fringe of mucous membrane which adhered to the superior maxilla, and the edge of the lower flap was united in like manner close to the inferior maxilla. The separation of these tongue flaps revealed a raw muscle surface, which naturally furnished the best sort of a base upon which to implant the superficial tissues of the cheek. By undermining the skin above and below the external defect, I had no trouble at all in bringing its edges together. A few silk-worm sutures were placed through the skin and the body of the tongue, in order not only to approximate the edges of the former, but, at the same time, to obliterate any dead space which might otherwise have formed.

I will state in passing that the patient had no teeth at all on the operated side. Three days after operation a few drops of saliva escaped through the wound; five days afterward all looked well. When eleven days had elapsed, the silkworm sutures were removed and the healing found to be perfect in every particular; the tongue was naturally anchored in place. Fifteen days after the operation I examined the patient and found that chewing, talking and swallowing were absolutely normal. One month after the procedure he expressed himself as being delighted with his condition, the scar was soft and yielding, he had no difficulty in opening and closing his jaws, while the change in his external appearance was surprisingly slight.

An examination of the interior of the mouth showed the tongue firmly fixed in its new position, but still capable of a very wide range of movement.

It may be stated in general that the method could be made applicable to any patient, simply by withdrawing the teeth on the afflicted side, and I am confident that the surgeon who tries it will be astonished at the ease with which he can close almost any defect in the cheek.

INJURIES AND DISEASES OF THE HYOID BONE.*

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THE hyoid bone is a small structure, and is situated in such a position as to be well protected from injury, yet one is surprised to find so little space devoted to a study of its diseases and injuries. A careful search of the literature will show only a moderate consideration of the fractures of this bone, and almost none of its other pathological conditions.

Fractures of the hyoid bone are of very exceptional occurrence, and are usually produced by a direct blow or fall, or by lateral compression, as by the pressure of an adversary's hand on the throat, and in a few cases by muscular contraction. It is also well known that the bone is sometimes fractured by judicial, but not by suicidal hanging. The fracture is usually that of one of the greater cornua, but occasionally the body of the bone has been broken and fracture of both cornua has been observed. As the bone is usually broken by throttling, the right cornu is the part most often fractured, owing to the pressure of the right thumb of the assailant.

The symptoms are generally quite characteristic; the patient usually feels a distinct snap, or sensation of a solid body giving way in the upper part of the neck, with severe pain, difficulty in speaking, swallowing or even in breathing, and cough. Increased mobility of the parts may be elicited, and sometimes crepitus. The fragments may be driven inwards and perforate the mucous membrane of the pharynx and cause bleeding from the mouth. Swelling and ecchymosis may occur externally, and a finger introduced into the pharynx may feel the ends of the broken bone. The injury is serious from its accompanying complications, and death has followed in several

* Read before the Southern Surgical and Gynæcological Association, December 11-13, 1906.

instances, but if life is preserved, bony union usually takes place. I have a well marked example of fracture of the hyoid bone with bony repair, in my collection, obtained from a cadaver (Fig. 1).

The treatment is directed more towards relieving the threatening symptoms than towards the fracture. If there is severe dyspnoea, a tracheotomy may be required; if dysphagia, the patient must be fed for many days through a tube, or by rectal enemata. Silence must be enjoined and all movements of the tongue prohibited. The fragments may be replaced by pressure with the finger in the pharynx, and counter pressure from without, and the head should be immobilized in the extended or flexed position, as is most comfortable to the patient and most effective in preserving reduction. If apposition cannot be maintained, I do not see any objection to suturing the fragments together. At times an abscess forms and a sequestrum may be thrown off. Occasionally the voice is changed for a long time, or permanently.

Inflammations of the hyoid bone may result from external violence or from constitutional disease, and usually begins as a periostitis, with localized pain, swelling, dysphagia and dyspnoea. Suppuration generally occurs, and if the pus is not promptly evacuated it may burrow in many directions, and cause extensive havoc. Necrosis of the bone is likely to occur in such conditions, usually limited in extent, though the whole bone has been known to die and be cast off. After the extrusion of the sequestrum, the functions of the bone appear to be but little affected.

Neoplasms of the hyoid bone are of great infrequency, and I have only been able to find five or six cases reported in the literature that is accessible to me.

In most of the works on surgery which I have been able to consult, no mention is made of tumors of the hyoid bone at all, and the references to the subject in the literature are exceedingly sparse. A writer in von Bergmann's Surgery, American edition, 1904, page 38, says, that only two cases of primary tumor of the hyoid bone are recorded in all litera-



FIG. 1.—Fracture of great cornu of hyoid bone.

ture. The occurrence of neoplasms of the hyoid bone, both primary and secondary, is without doubt of great rarity, but I have been able to collect five or six cases, inclusive of one of my own, which I will report briefly at this time.

CASE I.—*Enchondroma of the hyoid bone*, reported by E. Boekel in the *Gazette de Strasbourg*, in 1862, with the remark that it "is unique in literature."

"A woman, 50 years of age, observed in 1859 a tumor on the right side of the throat, which gradually increased in size. The neoplasm was the size of two fists, fluctuating, and hard at its base like cartilage. It raised up the inner head of the sterno-cleido-mastoid and pressed against the larynx, then extended under the chin and terminated in a blunt point 2 cm. below the sterno-clavicular articulation. It was somewhat movable, and the skin was not adherent to the growth. The thyroid gland was small and not involved. Swallowing solids was very difficult, but respiration was not impeded. On puncture of the tumor several grams of liquid jelly escaped. There was no pain. Extirpation was done, and the growth was found to arise from the horn of the hyoid bone, which was resected and the tumor easily removed. There was very slight bleeding. The growth was 12 cm. long and 7 cm. thick. It rose from the periosteum of the horn of the hyoid bone, and consisted of hyaline cartilage with a great number of cells. The patient did well until the fourth day, when secondary hæmorrhage set in, and notwithstanding the ligature of both the external, and, later, common carotid artery, she died of anæmia and exhaustion."

This case is quoted by Dr. J. Spisharny, of Moscow, in the *Deutsche medicinische Wochenschrift*, vol. xviii, p. 853, 1892.

CASE II.—*Tumor springing from the horn of the hyoid bone, causing suffocation through lateral compression of the epiglottis*. "On November 5, 1867, a man, aged 23, appeared, of fair and delicate complexion, who spoke in a very guttural manner, as if his mouth was full of food. Six months previously his voice had become affected, commencing with a cold and sore throat. A swelling formed on the left side of the neck, which affected speech and swallowing, with dyspnœa at times, especially at night, and sometimes a little cough. He could swallow solids and liquids, but as the tumor increased in size this varied, and he became thinner. His previous health had been excellent. He became very weak, with a feeble pulse. The fauces appeared healthy. By laryngoscopic examination a rounded tumor the size of a large walnut was seen on the left side of the throat at the root of the tongue and pushing the epiglottis to the right and compressing the epiglottis laterally, so that it looked as if folded in two. The entrance to the larynx was obstructed. The tumor appeared somewhat ulcerated, and was hard, but not painful. In the neck externally there was a swelling above the thyroid cartilage and connected with the left horn of the hyoid bone. It had increased in size somewhat rapidly of late. No operation was done and the man returned home,

where he died suddenly on November 9, 1867. The growth was supposed to be malignant, but no microscopic examination was made."

Reported by Sir G. Duncan Gibb in the Transactions of the Pathological Society of London, vol. xix, p. 59, 1868.

CASE III.—*Primary enchondroma springing from the great horn of the hyoid bone. Excision and recovery.* "On March 22, 1891, a man, 25 years old, came under observation. On the right side of the throat, immediately below the lower jaw, in the location of the hyoid bone, was a tumor the size and form of a hen's egg. The skin was not altered, and was movable. The tumor was rough, hard and but slightly movable, and was connected with the right horn of the hyoid bone and followed the movements of this bone. It was not painful. The thyroid cartilage was pushed to the left of the middle line. The orifice of the larynx could not be seen, but a lump the size of a walnut could be felt at the base of the tongue, which was rough, hard and but little movable, and was connected with the growth in the throat. The corresponding tonsil was swollen. A laryngoscopic examination was impossible. Swallowing solids was difficult, the voice hoarse, and respiration labored when he was on his back. The respirations were 26 to the minute. The patient was well nourished and the other organs normal. Eleven years ago he noticed that his voice was hoarse. No lump was observed at that time, but five years later the swelling was noticed and grew slowly. Five months before coming to the clinic he began to have dysphagia, and marked hoarseness of voice. On April 10, 1891, under narcosis, Professor Sklifosowsky operated in the following manner: An incision was made at the level of the angle of the mouth and extended in a curved manner to the cricoid, the sterno-mastoid, and vessels pulled outwards and the growth enucleated, when it was seen that it had developed from the right horn of the hyoid bone. Releasing the growth was not easy, and was accomplished by blunt dissection with the index finger. The bleeding was slight. Only the facial, lingual, and a few small vessels were ligated. The right horn was excised at its junction with the body of the bone. He was discharged well in a month. After the operation the temperature remained normal, the voice became clear, and the breathing and swallowing perfect. The tumor was irregularly oval in shape, length 7 cm., breadth 6 cm., and thickness $4\frac{1}{2}$ cm. The structure was mostly hyaline cartilage, rich in cells, and the tumor surrounded with a connective-tissue capsule."

Reported by Dr. J. Spisharny, *Deutsche med. Wochenschrift*, vol. xviii, p. 853, 1892.

CASE IV.—*Mixed round and spindle-celled sarcoma of the hyoid bone. Recovery.* "The patient was a negro, aged 24 years, married, waiter. No family history of malignancy but of tuberculosis. Has had gonorrhœa, but not syphilis. There was a lump the size of an English walnut beneath the chin. The skin was stretched and ulcerated at one point; the larynx was not involved. The tumor is away from the median line and upon the right greater cornu of the hyoid bone. It has been growing for five months, and has been painful one month, and is now very tender. Deglutition and respiration are interfered with. Chloroform anæsthesia.

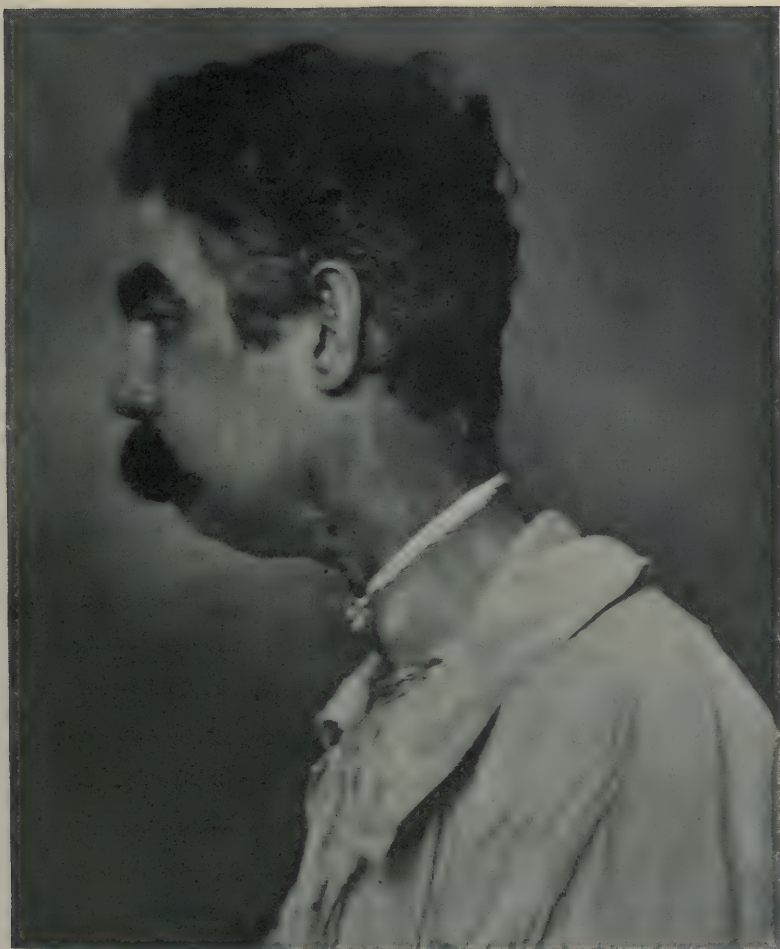


FIG. 2.—Total extirpation of hyoid bone, base of tongue, larynx and part of pharynx for sarcoma. 1906. Recurrence.

Operation on April 7, 1898. Dr. Dawbarn excised the left external carotid artery. Ten days later the right carotid was excised, and the growth ablated. The tumor was encapsulated and easily removed. It was attached to the greater horn of the hyoid bone, and one-half of the hyoid was removed. The mouth was not opened, nor was the thyro-hyoid membrane torn. Some suppuration occurred, but the man recovered and resumed work."

Prize essay by Dr. R. H. M. Dawbarn, "The Treatment of Certain Malignant Growths by Excision of the External Carotids," page 33.

CASE V.—*Sarcoma of the hyoid bone and larynx, with excision of the tumor of the hyoid, base of the tongue, larynx and part of the pharynx, under local anæsthesia.* Case of Dr. R. WINSLOW. (Fig. 2.) On January 9, 1906, Joseph Ward, age 45, white, tailor by occupation, was admitted to the University Hospital, having been sent in from the nose and throat dispensary, where he was examined by Professor John R. Winslow. He was at that time suffering from dyspnœa, due to a growth in the region of the hyoid bone, which so pressed on the epiglottis and larynx as to produce difficult respiration, and to prevent a laryngoscopic examination of the air passages. The diagnosis was tumor of the hyoid bone, involving the larynx. The patient is married and has four healthy children. His parents lived to a good old age, and he does not know the cause of death of either of them. He has had the usual diseases of childhood, as well as small-pox, and 16 years ago had a sore on the penis with suppurating inguinal glands, but this was not followed by any secondary symptoms. Thirteen years ago he noticed a small lump in the left side of the neck, which was excised by Professor W. W. Keen at the Jefferson Hospital, Philadelphia. Through the kindness of Professor Keen the following history has been obtained:

"Ward, Joseph, age 34, was admitted to the Jefferson Hospital on March 31, 1893; discharged April 6, 1893. He had a tumor in the right side of the neck the size of a hulled walnut. He complained of no pain or any other symptom. The presence of the tumor was the only physical sign. There was no family history of tuberculosis or malignant disease. The tumor was removed by Dr. W. W. Keen, April 1, 1893. He found it attached to the hyoid bone and the side of the larynx. Five days later the patient left the hospital with the wound entirely healed."

No pathological examination of the growth was recorded.

This history is probably erroneous in stating the tumor to have been located on the right side, as there was a well-defined scar on the left side of the neck and none on the right, and the patient said the growth was on the left side. He had been a regular drinker, but, he says, never to excess. After the removal of the growth mentioned above he enjoyed good health for three years, when he noticed a recurrence, and it has been increasing in size slowly ever since. About five weeks before admission to hospital the respiration began to be interfered with and there was some difficulty in deglutition. His voice is altered and he has some cough. He is pale, emaciated, and weak. There is marked dyspnœa, with stridor, which makes an examination of the chest difficult. The heart is exceedingly feeble and beats from 110 to 140 times a minute. The apex beat is not visible or palpable, but the heart sounds are clear and the second aortic sound is accentuated. The abdomen presents nothing of importance. There is a large swelling occupying the location of the hyoid bone and extending more towards the left than the right side of the neck. The enlargement is globular, as large as a goose's egg, hard, and freely movable. It is not painful, but causes discomfort. The Adam's apple can be seen and felt below the tumor, and the larynx is not enlarged or displaced. A skiagraphic picture fails to show the hyoid bone, but a shadow of a growth is faintly seen in the area between the jaw and the larynx.

On January 11 his respiration had become so impeded that immediate relief was demanded, and a laryngotomy in the cricothyroid space was done, under cocaine. This relieved his dyspnœa and rendered him much more comfortable. He was desirous of having the growth removed, but his condition did not justify such a serious procedure. He was therefore put on tonics, with digitalis, and fed well, and his pulse gradually increased in strength and diminished in frequency, ranging from 70 to 100 per minute, but still of very poor volume. As he still wished to be operated on, it was thought unwise to place him under a general anæsthetic, hence he was given one ounce of whiskey every hour by mouth from three to eight A.M., and morphia, grain one-quarter, and scopolamin, grain one one-hundredth, one-half hour previous to operation, and infiltration anæsthesia of the skin with Schleich's solution was effected. On February 1, 1906, he was properly prepared, and while still awake the operation was under-

taken and completed. The tumor of the hyoid was first removed with a part of the base of the tongue, when it was seen that the larynx was also involved. The incision was therefore extended downwards in the middle line, the skin reflected, and the whole larynx easily removed without hæmorrhage. The end of the trachea was brought out at a lower level and sutured to the skin. A large gap was left, leaving a wide opening into the pharynx. The pharynx was sutured to the base of the tongue and closed in the middle line so as to make a funnel-shaped canal, and the skin was loosely sutured. The patient stood the operation very well, complained of but little pain, and was in as good condition at its close as at its beginning. I am confident he would not have survived a general anæsthetic. He was returned to bed and put in an almost upright position to facilitate the swallowing of the saliva, and a tracheal tube was kept in the trachea. At first a large soft rubber catheter was passed from the mouth into the œsophagus and water and milk allowed to run into the stomach. but subsequently the lower part of the pharynx opened and the tube was passed into the œsophagus from the neck. There was a free discharge of saliva from the opening in the neck, which was kept from entering the trachea by wrapping the tracheal tube with gauze. The incisions healed promptly except a small place at the bottom, and the patient gained in strength. Three quarts of milk, with eggs and whiskey, were administered daily. He soon sat up and walked around the ward, and in a measure enjoyed life, but in the latter part of March there was a recurrence in the lower portion of the neck, as well as in situ, and he gradually failed and died on March 27.

The tumor was a round-celled sarcoma. A few injections of Coley's mixed toxines were given, as well as X-ray treatments, without benefit. The autopsy showed extensive metastases in the lungs, bronchial glands, liver, and mesenteric glands as well as in the tissues of the neck. I regard this case as a primary sarcoma of the hyoid bone, subsequently extending to the larynx, but of this there is doubt. Professor Hirsh, who examined the tumor of the hyoid, not finding any myeloid cells, is inclined to think the starting point was in the epiglottis.

The hyoid bone was completely destroyed by the growth, only some calcareous particle remaining, while the epiglottis was not entirely destroyed, nor was the larynx as much involved as

one would expect if the growth had originated in the epiglottis. The patient said the growth began to recur three years after the removal of the tumor by Dr. Keen, approximately 10 years ago.

CASE VI.—*Osteoma of the right horn of the hyoid bone*, reported by Dr. John C. Warren, "Surgical Observations on Tumors," page 117. The patient was a man who applied to his father, Dr. John Warren, on account of a lump in his neck. This was a conical exostosis of the right horn of the hyoid bone, nearly three inches in length. This was excised and the man recovered.

Even secondary growths of the hyoid are of great rarity, but Spisharny mentions one case, in which Peter found a metastasis in the body of the bone, at the autopsy of a person who died of cancer of the œsophagus.

Tumors of the hyoid bone, as far as they have been reported, have been either sarcoma, enchondroma, or osteoma, and doubtless this bone is subject to all the neoplasms that are found in the other bones of the body, though with great infrequency.

In the cases tabulated the ages varied from 23 to 50 years of age, and five of the six occurred in men. The length of time intervening between the first observation of the tumor and the removal of the growth, or death of the patient, varied from five months to thirteen years. The growth also varied in size, having been the size of two fists in an enchondroma, goose's egg, hen's egg, conical osteoma three inches in length, and an English walnut.

Deglutition was affected generally, and respiration more or less embarrassed. The voice was altered in nearly all cases, and pain or discomfort was generally present. Cough was also present in some cases. Of the six cases five were subjected to operation with four operative recoveries and one death from secondary hæmorrhage. One case succumbed eleven weeks after the operation from local and general metastases, and one died suddenly without operation, probably from asphyxia, as the larynx was compressed by the growth.

The treatment of tumors of the hyoid bone, whether benign or malignant, should be thorough removal, at as early

a period as possible, with as much of the contiguous tissues as may be necessary. The extirpation of this bone, even when it becomes necessary to excise the larynx and other contiguous tissues, is not attended with extraordinary danger, and the possibility of a permanent cure in malignant cases depends upon an early and radical operation.

SYMPTOMS AND SIGNS IN URINARY LITHIASIS.

BY CHARLES LESTER LEONARD, M.D.,

OF PHILADELPHIA.

As the result of the greater diagnostic accuracy obtainable by the Röntgen method in calculous nephritis and ureteritis, a more exact differentiation is possible between the symptoms and signs of these conditions. It is, however, impossible to differentiate them with precision from intra- and extra-ureteral and renal conditions without the aid of the Röntgen diagnosis.

It is not the purpose of this paper to discuss the symptomatology of these other conditions, but to point out the differences in symptoms and signs between renal and ureteral lithiasis that have a bearing upon the indications for treatment, after the size and position of the calculus has been determined by the Röntgen method. In addition, brief mention will be made of other renal conditions in which aid in diagnosis can be expected from this method in favorable cases.

This study is particularly valuable, since such additional knowledge has formed the basis for new indications for treatment which are in a great part based upon the symptom-complex presented. These symptoms and signs are best studied by discussing the atypical symptomatology, and attention can be confined chiefly to those particularly indicative symptoms that materially assist in differentiating between ureteral and renal colic, and characterize the different stages in the progress of a calculus from the renal pelvis to the bladder.

This study has for its basis my series of 352 cases examined by the Röntgen rays for suspected calculus, and particularly the 71 cases in which a calculus has been diagnosed and the diagnosis confirmed by the recovery of the calculus either at operation or when it was subsequently passed.

The differentiation between ureteral and renal colic can-

not be approximated in possibly more than half the cases by the study of symptoms and signs alone. There are, however, certain symptoms and groups of symptoms which, if only in a measure definite, suffice to form accurate indications for treatment, when taken in conjunction with the findings of the Röntgen diagnosis. That they are sufficient and of value as determining factors is evidenced by the passage of calculi in 31 cases where the expectant treatment had been based upon these indications.

The symptoms and signs cannot alone form the basis for rational treatment, as they do not comprise all the accurate knowledge that can be obtained of these conditions. On the other hand, the Röntgen diagnosis, though accurate and explicit as to the size, number and location of the calculi, does not form of itself a sufficient indication for operative removal of the stone. The symptoms and signs must in addition, and in conjunction with the Röntgen diagnosis, show that the calculus endangers the functional efficiency of the kidney or ureter, and that it is improbable that it will pass by the natural channels.

In the early days of Röntgen diagnosis much meddlesome and unwarranted surgery was done in removing sterile and harmless bodies from the tissues. In a like manner the surgical removal of some calculi would be meddlesome surgery. The Röntgen diagnosis is accurate, but should not of itself form an indication for operative removal of a calculus. The effect of the calculus upon the kidney and ureter should first be considered, and this effect, as expressed in symptoms and signs, is therefore of value in determining the indications for treatment.

In addition to the value in determining the indications for treatment, the study of the symptoms and signs is valuable in suggesting the possible presence of stone in obscure cases, and that a calculus should be detected or excluded. There are many cases in which the symptom-complex points to the presence and progress of a calculus down the ureter, but where the symptoms have suddenly ceased and even the urine may have become absolutely normal.

It is essential to the integrity of the kidney to determine whether a calculus is present and has become quiescent or occlusive, or has passed into or out of the bladder without being detected. The symptoms subside in either case and yet, if the calculus remains quiescent it may form the locus about which irritation and infection take place; if it is occlusive, a hydronephrosis results and the functional life of the kidney is threatened, as the cessation of activity means final atrophy and degeneration. If, on the other hand, it is detected in the ureter the indications for treatment will depend upon its size and the progress of the symptoms and signs, while if it is shown to have passed or to be absent from the urinary tract no treatment is required.

There is little actually known regarding the causation or method of formation of stone, and yet many factors must be properly adjusted to each other, or the normal individual would be more liable to stone formation. Mr. Reginald Harrison has pointed out that if a normal man were to void only half the 10 grains of uric acid usually excreted in a day, by the concretion of the remainder he could in forty-eight days form a stone weighing not less than half an ounce. He says: "If the production of stone were dependent upon a single link rather than upon a chain of them, it is probable that these disorders would be far more common and general than they actually are."

It may be said in addition that stones are probably much more frequently formed than one might be led to suppose by the number of cases presenting themselves for examination. This has been illustrated in a manner by the greater frequency of ureteral as compared with renal stone, since a more accurate means has been determined for finding them and a more definite knowledge of their symptoms has led to a suspicion of their presence.

All ureteral calculi probably form in the pelvis of the kidney and many undoubtedly pass without giving rise to suspicious or severe symptoms.

The symptoms and signs of calculous conditions in the kidney and ureter are due to irritation produced by their pres-

ence, to injury which they inflict in their passage or movements, or to obstruction of function. The severity of the symptoms is often in inverse ratio to their size but proportionate to the extent to which they interfere with the function of the kidney.

In nephrolithiasis, the symptoms and signs, when due to the irritation produced by the calculus acting as a sterile foreign body, are very slight unless partial or temporary occlusion is produced. A lumbar ache, increased by exertion, with a constant but small amount of albumin, has been observed in these cases. Sometimes the calculus has been very large and the albumin has persisted for eight or ten years or longer; or it may be entirely imbedded in the tissues, or enclosed in a cyst or occluded calyx. Where the calculus is rough and adhesions are present, sharp pain may have been experienced and blood is often found in the urine. The movable renal calculus of medium size produces the most characteristic and intense symptoms, with blood, if it is rough, or accompanied by pus if infection is added. The intense agony and pain of renal colic, with its quick onset without prodromes, and its almost as sudden relief, are characteristic of obstruction of the hilum. It is the classical stone in the kidney, with pain radiating often in all directions from the kidney, down the ureter to the groin, the testicle and the thigh. Temporary obstruction and mild attacks of colic have been produced by the passage of blood clots and muco-purulent plugs. When infection has been present for some time there is an absence of all acute symptoms, a dull ache in the lumbar region and pus and earthy phosphates in the urine persisting.

The most constant signs in the obscure cases are a small constant amount of albumin or traces of blood, accompanied by a constant dull ache or sense of discomfort in the renal region. Palpation is of little diagnostic value unless a large, sterile stone is present without obstruction, when tenderness may be elicited if the pelvis of the kidney can be reached. Hydro- and pyo-nephrotic kidneys can be palpated, but the information gained is only confirmatory of more obvious symptoms except where complete obstruction is present. The pres-

ence of a constant lumbar ache, with persistent albuminurea of mild degree with an absence of any history of acute attacks of colic should always suggest the possible presence of a quiescent sterile renal calculus. This suspicion would be increased if there was a trace of blood found from time to time in the urine. There have been three cases of this character among those studied. In them fixed or encysted calculi of large size have been found, one calculus measuring over $2\frac{1}{2}$ inches.

It is particularly difficult during the first attack of colic to differentiate a calculus that enters the hilum of the kidney and blocks it, but does not enter the ureter, from the small calculus that has entered the ureter and can safely be allowed to pass into the bladder. The differentiation between renal and ureteral colic and the indications for treatment will be discussed after the review of the symptoms of ureteral lithiasis. As has been said, the irritation and obstruction produced by the calculus during its passage through the ureter are responsible for the symptomatology.

There is a wide range in the severity of these symptoms, depending upon the degree of irritation and the completeness and point at which the obstruction takes place, the size and character of the calculus bearing an evident relation. The symptoms are so clearly subdivided by the point at which the obstruction takes place that they will be studied according to this subdivision. The most common seat of impaction has been the uretero-iliac junction, and the second that point in the juxta-vesical portion of the ureter where it enters the wall of the bladder. The portion above and the portion below the uretero-iliac junction exhibit symptoms that are distinct and characteristic of their involvement, though in some cases there has been a merging of the one into the other. In general it may be said that the symptoms of calculus approximate those of renal lithiasis when the upper portion of the ureter is involved, while vesical calculus is so closely simulated by calculous involvement of the lower portion that in more than one of these cases the bladder had been opened and explored for stone.

In the upper portion of the ureter the seats of impaction

of calculi are at the uretero-iliac junction, where the ureter bends and is flattened in crossing the artery, and at a point of narrowing about an inch below the lower pole of the kidney. This latter point is where the larger calculi that pass from the kidney may become lodged and are then liable to give rise to acute symptoms of obstruction. These are the calculi that more frequently demand operative removal. The smaller calculi, since they produce less marked symptoms, are more difficult to detect and are often more dangerous on this account. They may cause complete obstruction with very few or no marked symptoms, or may even, when no larger than a grape seed, cause intense and acute paroxysms of pain, with hæmorrhage out of all proportion to their size. It is in the insidious attacks with few or masked symptoms that an exact knowledge of the position, size and location of the calculus is most essential to the safety of the patient. These cases have little danger so soon as the exact size and location of the calculus has been determined, and the presence of a bilateral urinary flow, with a normal excretion of urea established. The frank, open cases, with severe attacks of pain, lose their grave aspect when it is known that the calculus is small enough to pass and what its exact position is in the ureter. A previous history of a series of attacks increasing in frequency, after the exact diagnosis has been established, means in such cases that natural forces are working and are competent to finally expel the calculus. Each attack can then be welcomed as an evidence of continued activity and each as a step nearer permanent relief.

Occlusion generally precedes the onward movement of a calculus in the ureter. By obstructing the urinary flow it produces distention of the ureter and pelvis of the kidney. These, in contracting, produce the force which dilates the ureter at the seat of the calculus impaction, and pushes it onward. This process is slow and gradual and gives rise to symptoms that extend over long periods. There may be a constant lumbar ache that persists between attacks, with an increasing ache and discomfort, prodromal in character, during the distention of the ureter. The acute attack of ureteral colic following it,

and subsiding after the calculus has been pushed along or the urine has escaped around it. This flush-tank variety of hydro-nephrosis is characteristic of these attacks, but may also be caused by an interference with the urinary flow, as by twists or valves in the ureter.

The history of a calculus passing down the ureter is characteristic. Attacks increasing in frequency and generally in severity should lead to the suspicion of a quiescent calculus that occasionally produces obstruction and may or may not be passed, depending on its size, and its location in successive attacks. The attacks may not be identical in symptomatology, but a sufficient number of the symptoms are repeated to establish their identity, while the lumbar ache and discomfort precedes and follows each attack, becoming continuous as they come closer together.

Beside this prodromal lumbar ache that persists and subsides gradually after the sharp colic attack, ureteral lithiasis is characterized by the radiation of the pain. In the crisis of the acute colic there is generally a point in the line of the ureter from which the pain seems to shoot upward into the kidney and downward along the distribution of the genito-crural nerve. The point of greatest intensity is frequently over the seat of obstruction, and when the upper portion of the ureter near the kidney is involved the pain is accompanied by nausea and vomiting. This is more liable to occur when there is complete occlusion. The distribution of the pain differs from that of renal calculus in that it does not radiate around the body, and from that of calculus in the juxta-vesical portion of the ureter in that it does not approximate that of vesical stone. That is to say, the pain is felt in the scrotum, testicle or labium major, and down the thigh, and in the groin. It does not involve the glans penis, the urethra or the meatus urinarius. In addition to the pain, stone in the upper ureter often produces a reflex contraction of the psoas muscle, due apparently to irritation. There is found to be a characteristic tendency to flex the thigh upon the body in these cases and an unwillingness to extend it, even after the acute attack of pain has subsided.

Palpation in these cases often yields valuable results. While the ureter can be palpated and its thickened and tender condition noted, in other forms of chronic ureteritis, in calculus ureteritis it is often possible, not only to detect and palpate the distended ureter, but also to locate an exquisitely tender point, and even to feel the calculus. To palpate a calculus impacted at the uretero-iliac junction, the patient should lie with limbs extended. The bifurcation of the aorta into the common iliacs should then be found and the finger carried along the common iliac artery $1\frac{1}{2}$ to 2 inches. The pulsation of the iliac can often be felt, and if a calculus is present an intensely tender spot sharply localized will be encountered. This tenderness has been confused with that of an inflamed appendix, or a displaced and inflamed ovary, and these organs have been removed in some cases in which a calculus was subsequently found and removed from the ureter. The ureter may or may not be found distended above the calculus as a hydro-ureter, when distended as the result of occlusion the similarity to an inflamed appendix is more marked. Palpation is also of value when calculi lie low down in the juxta-vesical portion of the ureter, where they can be felt through the rectum or vagina.

The most characteristic sign of ureteral stone, especially the freely movable or small rough calculi, is repeated traces of fresh blood in the urine. This sign may, however, be entirely wanting if the calculus has been quiescent. Where obstruction has been present, sufficient to produce backward pressure upon the kidney, albumin may be found. When complete occlusion has taken place the urine may be perfectly normal, since it may come from but one kidney, but the daily amount of urea excreted may be too low. Infection and pus in ureteral lithiasis have accompanied calculi lodged just below the kidney or just outside the bladder, and has been sufficiently intense, with such grave acute symptoms as to demand immediate operation. In these instances the accurate localization facilitated and was confirmed by the operation.

The symptoms of calculus in the juxta-vesical portion of the ureter differ distinctly from those of calculus at or above

the uretero-iliac junction. The signs are nearly identical, though there is less liability to blood in the urine, and more chance of infection. There is often a history of previous attacks one, two, three or more years, or as many months, apart, with an increasing frequency during the last year or six months. The point of acute pain will be found, in a calculus that is passing down the ureter, to be gradually lower and will usually mark the points where impaction is most frequent. There is often a sense of fulness in the renal region, the result of an hydronephrosis of either passive or flush-tank variety. This is more common with calculus impacted at the uretero-iliac junction, while infection is more liable to occur when the impaction is near the bladder and the occlusion is incomplete.

The most noteworthy characteristic of the pain symptomatic of calculus in the juxta-vesical portion of the ureter is the closeness with which it resembles that of vesical or prostatic calculus. The presence of some of the symptoms of ureteral lithiasis and pain ascending to the kidney or down to the thigh should lead to a suspicion of the true cause. The symptoms simulating vesical stone are apparently due to the involvement of the same nerve supply and interference with the vesical trigone. The pain is referred to the glans penis or the meatus in the female and along the line of the urethra. It may be very intense, and is often felt while the bladder is contracting as well as at the end of micturition. Pain in the scrotum and testicle or the labium major, in the groin and the inner side of the thigh, are also often present with pain ascending to the kidney, and, less frequently, a dull lumbar ache.

Acute attacks of colic are more rare, especially if the calculus has been quiescent. Partial occlusion may result in hydro-ureter and hydronephrosis, or these may be combined with infection. Infection may produce very severe symptoms resulting in complete occlusion and often demands immediate operation. In one patient three calculi smaller than grape-seeds, together with infection, produced occlusion which was relieved and the calculi removed by operation at the seat of impaction. In other cases the bladder has been opened and

explored for encysted calculi or has been treated for cystitis when the ureter was the seat of the disease. As in calculus situated above the iliac artery, there is great difficulty in differentiating calculus conditions of this portion of the ureter from extra-ureteral or intra-ureteral conditions. In fact, it is because the similarity in symptomatology is so close and an exact method of diagnosis did not exist, that the Röntgen method is so valuable and has made possible a closer differentiation in the symptomatology.

An exact diagnosis cannot be made without the assistance of the Röntgen method, even with the more definite understanding of the symptoms. Their study is most valuable as confirmatory evidence and in securing data upon which the

The differences in the symptoms of renal and ureteral colic are that the onset and end of the attack are more sudden. Ureteral colic is preceded by a prodromal lumbar ache that becomes more intense until the crisis or acute attack of pain. This lumbar ache subsides by lysis and may not entirely disappear between the colic attacks. The pain is localized at the seat of obstruction in the ureter and radiates upward as well as downward. In the kidney the pain is most acute in the region of that organ and radiates downward or around the body, while if there has been an ache from a quiescent renal calculus, it has not gradually increased in volume, and is generally absent after the attack. In colic due to calculus in the upper ureter there is generally reflex irritation of psoas muscle and contracture, while palpation will detect a distended and tender ureter with an acute point of tenderness at the seat of impaction. The hydronephrotic kidney can be felt sometimes in both conditions, but is fluctuating and of the flush-tank variety in ureteral stone.

In calculus impacted in the juxta-vesical portion of the ureter the symptoms of ureteral calculus are combined with those of vesical stone, with the absence of the psoas reflex and the point of tenderness at the uretero-iliac junction. There is less liability to lumbar-ache and fewer attacks of colic, especially if the calculus has become quiescent.

The previous history of the attacks, with their intervals, is very valuable when the information is given by intelligent persons. With a series of attacks extending over a period of months or years, with a shortening interval between the attacks and pain localized during the acute colic lower and lower down, with at first no lumbar ache and finally a persistent lumbar ache, or ureteral and vesical symptoms intermingled, the picture is complete of the progress of a calculus down the ureter, and it becomes almost certain if to this history and symptoms that are confirmatory is added the presence of occasional traces of blood. But even with so typical a history and the subsidence of symptoms it is impossible to say that a calculus was ever present, or if present that it has not passed undetected.

Such a history, or even a partial history with many symptoms lacking, in the presence of a small stone detected by the Röntgen method, is sufficient evidence upon which to base a rational course of treatment. If the urinalysis shows that a normal amount of urea is being excreted; if the attacks have been intense and if a lumbar-ache persists, there is evidence that nature is attempting to expel the calculus, that the patient is in no immediate danger due to suspension of functional activity, and that the kidney and ureter still possess sufficient contractile power to expel the stone.

If, on the other hand, the calculus is large, and frequently repeated attacks of colic fail to produce any change in its location, or if infection is present, or acute symptoms develop, or the amount of urea becomes persistently low, the indications for the immediate removal of the calculus are present.

The detection of a large calculus in the kidney is an indication for operation unless the calculus is producing but few symptoms and the age of the patient or any physical disability makes the operative risk grave.

A small calculus in the kidney without complications, where there has been but one or two colic attacks, may be permitted to remain, as they are frequently passed, one patient passing a small calculus from the kidney and out of the bladder on the day set for operation.

The tolerance of the kidney and ureter for small sterile calculi is so fully demonstrated by many cases that have passed numerous calculi in series, that the detection of a calculus is not an indication in itself for operation. Multiple calculi either in both ureters or in the kidney and ureter are indications for primary operative removal of the calculus in the ureter. Multiple calculi detected in one ureter have all been passed in two or more cases. The mortality in ureter-lithotomy is high, especially for calculi situated below the iliac artery, and in the presence of 31 cases of ureteral calculus that have passed the calculi after the patients were put upon the expectant treatment, operation seems to be justified only in the advent of acute symptoms, or where both urinary tracts are involved.

As I have said in a former paper (*The Lancet*, London, June 17, 1905) "While the presence of an undetected calculus may be a grave danger and a menace to the integrity of the kidney, as soon as its exact size and location are known that menace cease, unless there are symptoms present that indicate a progressive impairment of the function of the kidney. Comparatively few migrating calculi give rise to anuria, or a greater proportion of patients suffering from ureteral stone would die."

With the knowledge that so many patients pass calculi, and an accurate method of determining their size and location, it is rational therapy to permit nature to accomplish that which she has accomplished in a large number of cases.

Because of the exact knowledge obtainable the patient's safety can be guarded during such expectant treatment and operation can be directed to the seat of obstruction if it is needed. It is, however, irrational to operate because a calculus has been detected unless it threatens the integrity and functional life of the kidney.

Although the same accuracy and detail have not been obtained in other pathologic conditions of the kidney, much that is valuable and assists materially in diagnosis can be secured in favorable cases. Thus displacements, hydro- and pyo-nephroses and hypertrophies of the kidney have been

demonstrated. Pus or debris filling the pelvis of the kidney have been detected and the pus has been washed out through the use of the ureteral catheter. Cysts external to the kidney and gross collections of pus in the cortex, as well as the more marked surgical kidney, have been recognized. These refinements in diagnosis can be obtained only in favorable cases and by careful study of the negatives. It is not always possible to determine or distinguish one condition from another, and yet there is absolute evidence to the expert observer of a pathological condition.

In closing, it is perhaps worthy of note that in none of the 352 cases examined for a diseased condition of the kidney, has any deleterious effect been observed as the result of the examination, with the exception of some cases of dermatitis among the earlier cases. No dermatitis has occurred during the past four years. The innocuousness of Röntgen examinations is apparently demonstrated by these cases with renal disease and the thousands of other cases examined without harmful results.

TUBERCULOSIS OF THE BLADDER.

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(Concluded from page 408.)

PART III.

RESULTS.

IN 477 cases, results of treatment were given. In 44 of these the statements were so indefinite that they were rejected from the following list:

Deaths.....	161	Cured.....	29
Improved.....	130	Made worse.....	6
Not improved.....	77	(Indefinite).....	44

Deaths.—In the 161 deaths, there were 49 cases in which an operation of some kind had been performed; in 7 of these death was directly due to operative interference, in 42 it occurred at a remote period. The operations in the fatal cases were as follows: 28 suprapubic cystostomies, with curetting, cauterization with the Pacquelin cautery, excision of ulcer, etc.; 10 perineal sections; 5 nephrectomies; 3 prostatectomies; 2 nephrotomies; 1 vesico-vaginal incision. Of the 7 deaths which were due to operative interference (these are included in the above list) 3 followed a perineal section; 2 excision of the diseased area; 1 suprapubic cystostomy; in 1 the cause was not clearly stated. It is probable that there were more fatalities, but only those cases have been selected in which death occurred within the first few days after operation.

The cause of death in the great majority was not specifically stated; 4 patients died in coma; 2 from acute miliary tuberculosis; others from general tuberculosis, exhaustion, suppression of urine and other complications.

Improvement.—130 patients are said to have improved—

some only slightly, others markedly so, and a few were almost cured. Among the procedures employed were 48 suprapubic cystotomies; 23 iodoform injections; 18 sublimate instillations; 10 medical treatments; 5 curettings through the urethra in females; 5 perineal sections; 4 instillations of gemol; 3 vesico-vaginal incisions; 2 changes of climate; 2 excisions of the ulcer; 2 injections of tuberculin, 2 nephrectomies; 1 cauterization through the urethra in the male; 1 guaiacol injections, and 1 vesico-vaginal incision with suprapubic cystotomy.

The average age of the improved patients was 31.02 years.

No Improvement.—There were 77 cases in which in spite of treatment no benefit followed. Among the procedures employed were 34 suprapubic cystotomies; 15 instillations of sublimate; 10 curettings of the bladder through the urethra in females; 7 instillations of iodoform; 3 irrigations; 2 instillations of gemol; 2 perineal sections; 2 medical treatments; 1 excision of the ulcer: 1 suprapubic and perineal section combined. The average age of these patients was 27 $\frac{1}{3}$ years.

Cured.—There were 29 cases reported as cured. In these there were 9 suprapubic cystotomies with curetting, cauterization, iodoform drain, etc. (Bell, Guyon, Routier, Loumeau, Battle, and Carleton); 8 nephrectomies (Albarran, Koenig, Bougle, Kapsammer); 5 changes of climate (Bangs, Cumston, Camero, Desnos); 2 curettings of the bladder through the female urethra, (Polak, Motz); 2 sublimate instillations (Guyon); 1 iodoform injection (Jamin); 1 medical treatment (Richter); 1 nephrectomy with suprapubic cystotomy (Meyer).

Among the cured patients there were 13 males and 10 females; in 6 the sex was not given. The youngest was 11 and the oldest 49. The average age was 28.87 years.

In making up the foregoing list I have aimed to be as fair as possible, but I think I have leaned toward the inclusion of some cases which were doubtful.

A synopsis of a few of the excluded, doubtful, and specially interesting cases is as follows: Mullin's patient is referred to as cured, but at last accounts complained of consid-

erable frequency of urination during the day, which would argue that there must still have been some bladder irritation. It is presumable, therefore, that the disease was still mildly active.

Strauss' case is not one of undoubted tuberculosis, for at no time were tubercle bacilli found in the urine, and the ulcer in the bladder was single and situated on the anterior wall. (Not included.)

Griefenhagen reported a cure after perineal section, but in his last record he says that both cords were still thickened. Such being the case, doubt is thrown on the complete recovery of the bladder. (Not included.)

Clado recorded a cured bladder tuberculosis. The diagnosis was made, however, only on the appearance of the granulations in the bladder at the time of operation. This case is included but is not absolutely positive.

Polak's patient had tubercle bacilli in the urine and the cystoscopic examination showed a tuberculous mucous membrane. This, then, I take to be an undoubted instance of cured bladder tuberculosis.

The tuberculosis in Bangs' record is unquestionable. A perineal section and suprapubic cystotomy were both employed without improvement, after which the patient went to California and was apparently cured.

Cumston gives the clearest and most undoubted example of the list. A girl aged 11 had tubercle bacilli in the urine proved by the microscope and by inoculation into a guinea-pig; there were also typical tuberculous lesions in the bladder which were carefully observed through the cystoscope. She was treated with local applications of lactic acid once a week, and iodoform oil was injected every fourth day. This was kept up for four months, when she was sent to Bermuda and remained there for several months; on her return the bladder was again cystoscoped and the lesions were found to have healed; no tubercle bacilli could be discovered in the urine and inoculation of a guinea-pig proved negative.

Carleton's report, which is included in the above list under

the head of suprapubic cystotomies, is as follows: Male, 39, had had several attacks of hæmaturia; later, frequent and painful micturition developed, and tubercle bacilli were found in the urine. A suprapubic cystotomy was done, a large stone was found and definite tubercles were seen on the mucous membrane. After the operation the patient rapidly improved and the tubercle bacilli disappeared. While it is stated that the organisms were found in the urine, and that definite tubercles were present on the mucous membrane, the bacilli were not differentiated from smegma bacilli and the tissue was not proved to be tuberculous by microscopic examination. Then, too, the symptoms cleared up so rapidly that, taken altogether, there must remain some doubt about this case.

The report of McGrath was not included. In this instance there were no tubercle bacilli in the urine, nor was any tissue of the bladder removed and examined, the diagnosis being made simply on the appearance of the mucous membrane at the time of operation. The bladder was drained for six weeks, and at the end of ten months the urine was clear and the other symptoms had disappeared.

Cotterel's case has been referred to in the literature as an instance of cure. No tubercle bacilli were found in the urine, and there was no tuberculosis, as far as could be made out, in the other genito-urinary organs. The bladder showed a small ragged ulcer just above the right ureter, but otherwise there were no characteristic signs. The mucous membrane was curetted and touched with the Pacquelin cautery; the wound healed readily and the patient became entirely well. (Not included.)

Reynès case is reported as an example of recovery. The author states that the patient was very much improved, but does not say that he was well. (Not included.)

Battle had an undoubted instance which was cured after operation. The patient, a female aged 11, had had various forms of treatment without benefit. A suprapubic cystotomy was done and the bladder was curetted and cauterized with chloride of zinc. She made a slow, but apparently complete

recovery, for at last accounts her health was good; she had no bladder symptoms, and was able to hold her urine for three hours. The tuberculous nature of this case was proved by the examination.

McGowan reports 10 suprapubic cystotomies for tuberculosis of the bladder with 4 cures. The cases said to be cured were never definitely proved to be tuberculous. (Not included.)

Botsford cites an instance of a cure by hypodermic injections of nuclein. (Not included.)

Richter is said to have cured a bladder tuberculosis in a girl by the use of ichthyol administered internally. (Not included.)

Guyon had only 1 suprapubic cystotomy case that was practically well afterwards. (Included.)

Horwitz has seen 2 cases of bladder tuberculosis subside spontaneously. (Not included.)

Personally I have not observed in my practice, nor has there been in the general surgical wards of the Johns Hopkins Hospital a single instance of complete recovery from bladder tuberculosis.

Made Worse.—There were 9 cases recorded as being made worse: 3 from sublimate instillations; 2 from injections of tuberculin; 3 from perineal sections; 1 from injections of guaiacol; and 1 from injections of iodoform. After the instillation of sublimate, in one of the above, there was great increase in the frequency of urination and a rapid implication of the prostate. The average age of the patients who were made worse by treatment was thirty-four years.

Excision of the Diseased Area.—There were 13 instances in which the diseased mucous membrane was excised through a suprapubic opening; 2 of these patients died from the effects of operation; 8 died at a later period; 2 were improved; and 1 was unimproved.

The bladder was completely excised with transplantation of the ureters into the rectum, twice; both patients died some time after.

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CIRCUMCISION.—A PLASTIC IN CONSTRICTED PREPUCE.*

BY OSCAR H. ALLIS, M.D.,

OF PHILADELPHIA,

Surgeon to the Presbyterian Hospital.

THE skin covering the penis differs in many respects from the integument in the other parts of the body. It is thin, elastic, has little if any subcutaneous fatty tissue, is loosely connected with the organ it covers, and at the free end of the penis instead of uniting at the terminus, as is the case with the fingers and toes, turns inward and finally becomes attached to the organ just behind the corona glandis. Thus the glans penis gets two layers, or rather two thicknesses, of true skin. This turning in of the skin serves an important function: it presents an epithelial skin surface to the epithelial surface of the glans penis and, as epithelial surfaces do not ordinarily fuse or unite, a permanent opening is left for the urethral canal to discharge the accumulations of the bladder.

The turning-in of the preputial covering must necessarily make the terminus less distensible than other parts, and it is not uncommon to find the preputial orifice narrowed at birth and resisting efforts at retraction. Some years ago my colleague on the staff of the Presbyterian Hospital, Dr. De Forest Willard, called attention to this narrowing of the prepuce and to the presence around the glans of a secretion that required removal. His article directed attention to a much neglected subject and elicited commendation from sources that would have been supposed to be familiar with the subject.

The importance of attention to the cleanliness of the glans penis while the child is in early infancy is not as generally practised as it should be. Between the prepuce and the glans penis there is at birth some inspissated smegma, and this, if

* Read before the Philadelphia Academy of Surgery, January 7, 1907.

permitted to remain, will occasion irritation that will give rise to uneasiness and repeated attacks of non-specific balanitis. Hence, as a result, the inner surface of the prepuce and the glans penis becomes inflamed; the epithelial surfaces are covered with granulations, and ultimately the prepuce becomes adherent to the glans. This in itself would not be the source of further irritation were there not imprisoned the old inspissated smegma. The chief collection of this secretion is back of the corona, where it serves the purpose of perpetual annoyance.

I have seen three types of neglected prepuces in the adult. In one instance there was retention of urine. Dr. Roger Keys asked me to see a young man with retention of urine whose constriction would hardly admit a probe the size of a darning needle. When I entered the house I found him in the act of urinating. He was standing erect, leaning against a wall, and flowing from the penis was a fine spray that shot upward and forward for a distance of six or eight feet; the bladder was relieving itself under spasm. In a second case the glans penis had become adherent to the preputial covering and the most careful dissection could not uncover it. In this case the superficial surface of the prepuce was retracted, but in doing this a raw surface was all that was left for the glans. In a third case, epithelioma had resulted and amputation was necessitated, in a case that I had no reason to suspect an impure life.

In many children a marked redundancy of prepuce will be noticed. There is good reason to believe that this is occasioned by the traction the child makes upon the skin in efforts to relieve irritation. A redundant prepuce may resist retraction, it may be constricted and be as mischievous as the constricted and contracted variety.

Circumcision is relegated by works on operative surgery, and by the profession generally, to the class of minor surgical operations, as if it were a matter of so little consequence that it hardly deserved attention. But practical experience has much to say to the contrary. There is scarcely a surgeon of general practice who has not been called upon to

patch up and complete the criminal mutilations of incompetent operators.

An operation that is very widely practised consists in obliquely claspings the prepuce just anterior to the head of the glans, and with a single sweep of the knife removing the redundancy. The outer skin covering is now retracted and the inner mucous one trimmed off near the corona and parallel with it, leaving just enough to easily attach the skin flap. This usually results in a comely appearance. After attaching the two surfaces, I usually carefully test the freedom of the preputial covering and often nick the inner coat at its junction with the glans penis, since the least constriction in the mucous layer is apt to provoke swelling.

In all my early operations and in most of the operations I have witnessed, the glans penis is permanently uncovered. Whether this is the best possible result or not I do not know. One thing only I know, that the glans penis is always covered at birth, and it would seem that a hood that partially if not completely covered the organ, and which could be readily retracted for cleanliness, would be nature's model.

In some cases the prepuce is closely drawn over the head of the organ. In such, a simple splitting of both coverings upon a grooved director, from opening to the corona, yields a very satisfactory result. The dog-ears present at first shrink and leave no trace in after years of their early redundancy. The only objection to this operation is that it leaves the glans permanently uncovered, and it is with a view to preserve the original appearance, viz., partial covering for the glans, and at the same time have a retractable hood, that I have been led to contrive and practise the following operation:

Fig. 1 represents three steps in the operation. *First*, circumcision at the extremity of the prepuce. *Second*, making a V-shaped flap extending from the primary circumcision to a little beyond the greatest circumference of the glans, and, *Third*, carrying the incision from the base of this flap around the organ on dotted line. All of this is done in the outer skin covering. Fig. 2 represents the skin retracted and a dotted line

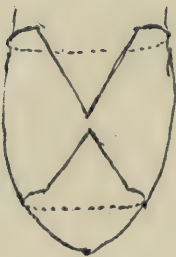
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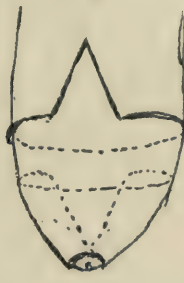
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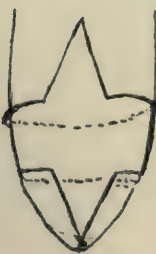
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extending from the point of primary incision upwards. Fig. 3 represents the effect of slitting up the inner or mucous layer. Fig. 4 represents the inner layer retracted and ready for suturing and the half covered glans penis.

The steps of this operation may be reversed, and instead of making the V-shaped flap in the outer skin layer it may be made in the deeper inverted or mucous layer. The chief difference between the two is that the frenum is not approached in the operation just described, while in the second the circumcision of the inner covering may do so.

Fig. 5 represents the glans covered and two steps in the operation, viz., the primary circumcision through the outer skin layer of the prepuce and an incision through it to a point in the greatest circumference of the glans. Fig. 6 represents the skin retracted and a dotted line extending from the preputial opening back, V-shaped, and the same dotted line extending around the glans. Fig. 7 represents the effect of the incision following this line. Fig. 8 represents the inner or mucous layer reflected and ready for suturing.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, January 9, 1907.

The President, DR. GEORGE WOOLSEY, in the Chair.

EPITHELIOMA OF THE TONGUE: FOUR YEARS AFTER OPERATION.

DR. CLARENCE A. MCWILLIAMS presented a woman who was twenty-four years of age when she was admitted to the Presbyterian Hospital, in August, 1902, complaining of a painful lump on the side of the tongue, which she had first noticed three months previously. Pain on chewing was very severe, so that she took only fluids. She had lost much flesh and strength.

Examination showed a hard, superficial lump about the size of a dime, situated on the left edge of the tongue, about 1 inch from its tip. There was no ulceration. It extended just to the dorsum, and impinged very slightly on the mucous membrane of the floor of the mouth, but not as far over as the attachment of the mucous membrane to the lower jaw. The tongue was freely movable. Opposite the lump there was a sharp carious tooth. One gland, the size of a marble, could be felt under the angle of the left jaw. A section which was removed showed flat-celled epithelioma, full of epithelial pearls.

Operation was performed on August 20, 1902, more than four years ago. Under morphin and ether narcosis, a curved incision was made below the jaw, exposing the submaxillary triangle. This flap was dissected up, uncovering the submaxillary gland, which seemed enlarged. The external jugular was divided, and several small lymphatic glands were removed, with all the fatty tissue in the triangle. Under the angle, one gland, about the size

of a marble, was excised. The lingual artery was tied in the usual place. The head was then turned strongly to the right, the mouth held widely open by a mouth-gag, and a stout silk thread transfixed the tongue which was drawn well into view. An incision was then made, widely encircling the growth on the dorsum, and extending deep through the tongue into the muscles on the under surface. The knife, passed from below upwards along the inner surface of the jaw, divided the mucous membrane at its attachment to the jaw. The entire mass was then removed in one piece through the mouth, consisting of a section of the tongue, with the growth, the muscles of the tongue, and the submaxillary and sublingual glands. The hæmorrhage from the raw area was minimal. The raw edges of the tongue were brought together with catgut, excepting for a distance of about 1 inch posteriorly. An inch and a quarter of the left anterior lateral portion of the tongue was removed. Pathological examination of the submaxillary and sublingual glands showed that they were not involved. The lymph gland removed from the angle of the jaw showed that it was affected with epithelioma.

The patient took X-ray exposures to the neck twice a week for one year after the operation. It was now almost four and a half years since the operation, and there were no evidences of a recurrence, although in view of the lymphatic involvement a recurrence had been expected. Whether the X-ray exposures contributed to the result could not be stated, but it was doubtful. The case emphasized the necessity of removing all the lymphatic glands, even in very small and early growths, and brought up the question whether in these cases it was advisable to always remove the glands from *both* sides of the neck even when they were not palpable, or should we limit the removal to the side of the neck on which the growth was situated?

The age of this patient at the time of operation, twenty-four years, was somewhat unusual. Her speech now was practically perfect. Examination showed that the tip of the tongue was drawn to the left, and tightly attached to the jaw.

NEPHRECTOMY FOR HYPERNEPHROMA.

DR. CHARLES H. PECK presented a man fifty-three years old, who was operated on for chronic appendicitis about two and a half years ago. His recovery was prompt and uneventful. In

June, 1906, he had right-sided pneumonia and pleurisy, followed by double femoral phlebitis. He was under treatment in a hospital for about seven weeks, and during a part of this time was said to have had albumin and casts in the urine. The urinary changes were thought to indicate an acute nephritis secondary to the pneumonia. Since the latter part of August, 1906, he was at his home, but did not gain in strength. He admitted having had a feeling of weight and discomfort in the right side of the abdomen for more than six months, but during his stay in the hospital he did not call the attention of the physicians to it, and was not definitely aware of the presence of a mass. This was suspected a month or so later, and, about the first week in November, after consultation, it was thought to be an inoperable growth involving the large intestine.

When the patient was first seen by Dr. Peck, in consultation with Dr. C. C. Page, on November 13, 1906, the patient was greatly emaciated, and weak and cachectic in appearance. A very large, well-defined mass filled the right side of the abdomen, and could be felt posteriorly. Its surface was smooth, its consistence firm and elastic, and the impulse from the hand in front could readily be felt posteriorly. The tympany of the colon could be traced in front of the mass.

There had been a tendency to constipation, but no obstruction, diarrhoea, or blood in the stools. There had never been any blood in the urine. A moderate elevation of temperature was present, and had persisted for some time. A well-marked valvular heart lesion had been present for a number of years, but compensation was good. There was a marked varicosity of the superficial veins of the right half of the abdomen and the lower thoracic region, which was said to have developed during the attack of femoral phlebitis above referred to. The patient had been failing steadily for several weeks. The tumor had increased in size perceptibly, and he had had a number of "weak spells" or attacks of partial syncope that were quite alarming.

A diagnosis was made of enlarged right kidney, probably a neoplasm, and an exploratory operation was advised. The possibility of a thick-walled hydronephrosis, with a recent low grade of infection, was considered.

Upon the patient's admission to Roosevelt Hospital, on November 16, 1906, his temperature was 101 degrees F.; pulse,

100. An examination of the blood showed 7,800 leucocytes, and 3,400,000 red blood cells; polynuclear cells, 76 per cent.; hæmoglobin, 70 per cent. The urine had a specific gravity of 1028; it was turbid; acid; contained a heavy cloud of albumin; no sugar. Cystoscopy, by Dr. Walter Klotz, with catheterization of the left ureter, showed that the left kidney was functioning well, and that the urine from that side was practically normal. No urine was observed coming from the right ureter, which was not catheterized. An X-ray plate showed no evidence of stone. The shadow in the right kidney region suggested tissue denser than the normal, similar to that seen in old pyonephrosis.

Operation was performed on November 19, 1906, under ether anæsthesia. An oblique incision was made posteriorly over the right kidney, which was later enlarged by the Koenig method. The kidney was much enlarged and tense, with many dilated veins in the fatty capsule. The exploring needle withdrew brownish fluid and particles of necrotic tissue. The anterior and posterior surfaces, at the upper and lower poles, were carefully freed from the surrounding tissues, which were quite adherent to the peritoneum. A large branch of the renal artery which entered the lower pole of the kidney had to be clamped and divided to allow the delivery of the kidney. Isolation of the pedicle was difficult. Heavy chromic gut ligatures were passed on an aneurism needle, and the pedicle transfixed and tied. A heavy clamp was placed distal to the ligatures, and the kidney removed by cutting through its substance near the hilum. Other chromic gut ligatures were placed behind the clamp and tied as it was slowly removed. The stump of the kidney was then trimmed off, two cigarette drains were inserted, and the wound closed in layers with chromic gut, silkworm and silk, excepting at the emergence of the drains. Time of operation, thirty-five minutes.

The kidney was enormously enlarged (Fig. 1). On gross section it was seen to be infiltrated throughout with necrotic-like tumor tissue. On pathological examination by Drs. Hodenpyl and Ditman it was pronounced hydronephroma.

The patient rallied promptly from the operation, and on the second day he secreted 31 ounces of urine. This contained a trace of albumin; no casts. The wound healed per primam. The patient was out of bed twenty days after the operation, and left the hospital on December 21, 1906. His urine on that day was



FIG. 1.—Hypernephroma of right kidney. Dimensions, 15 x 9 x 6 cm.; transverse circumference, 23 cm.; weight, 454 grammes. *A*, outer surface; *B*, cut surface.

acid; specific gravity 1012; it contained a trace of albumin; no casts. Since the operation he had gained in strength, and about 20 pounds in weight. The dilated superficial veins on the abdomen had not diminished in size.

DR. JOHN ROGERS said he was rather surprised that Dr. Peck had been able to shell out such a large renal tumor so easily. The speaker said that some years ago, in dealing with a case of this kind, he had found it necessary to divide the two lower ribs before he was able to deliver the tumor. A free exposure of the parts was also advisable, as it gave a better opportunity to control the free hæmorrhage that was at times encountered.

DR. PECK said that the curved incision, such as he used in this case, gave a fairly free exposure. In cases where the kidney was adherent at its upper pole it might be necessary to resort to the expedient of dividing the lower ribs, as suggested by Dr. Rogers. In the case he had reported, the hæmorrhage from the perirenal fat was considerable, as the veins were much dilated, but it was controlled without difficulty.

ILEOCOLIC INTUSSUSCEPTION.

DR. CHARLES L. GIBSON presented a male infant, seven months old, who was admitted to St. Luke's Hospital on December 16, 1906. His family history was negative, and the patient had always been well up to that time.

Five days before admission the mother gave the child a dose of castor oil which was followed by severe cramps, and vomiting at intervals. This condition continued for four days when blood was first noticed in the stools, and there was vomiting of greenish fluid, fæcal in character.

Upon admission, the child's abdomen was much distended and a fluid wave was elicited. A rectal examination was negative. The case was regarded as one of intussusception, and immediate operation advised. Upon opening the abdomen, the intussusception—ileum prolapsed through the valve—was found and easily reduced by manipulation. The child made an uneventful recovery, although for a week the temperature was frequently as high as 106 degrees F.

DR. ROBERT H. M. DAWBARN said statistics showed that both this condition and volvulus occasionally recurred, from the cause which originally induced the faulty peristalsis. In order to pre-

vent its recurrence, the speaker said that in two cases that had come under his care he stitched the gut to the adjacent abdominal wall at two or three points, with the idea of a temporary local limitation of peristalsis. As additional preventative measures, he suggested the use of opiates for two or three days after the operation, or after operation, in intussusception, of those two or three drugs that were known to produce reversed peristalsis.

STRICTURE OF THE ŒSOPHAGUS.

DR. GIBSON presented a woman forty-three years old; a native of Russia, who was admitted to St. Luke's Hospital on November 20, 1906. Her family history was negative. She had the usual diseases of childhood. Up to a year ago she had frequent attacks of very severe headache, with vomiting, which lasted for a day or two.

About a year ago the patient vomited a small quantity of bright red blood, and during the next forty-eight hours her stools were black in color. There was no recurrence of this until seven months later, when she vomited a larger quantity of bright blood and had tarry stools for two or three days. At that time she was in St. Luke's Hospital for eight days, but nothing was found to account for her symptoms, and, as she was in fair health, she was discharged. For the past eight months she had had gradually increasing difficulty in swallowing solid food; for three or four months she had been able to take nothing but fluids, and for the last few weeks even these had given her much trouble. On several occasions she had brought up blood, accompanied by the passage of tarry stools. She had never lost large quantities of blood, and her attacks of vomiting had usually occurred shortly after eating. She complained of a feeling of oppression over the lower end of the sternum, but no severe pain. She had a good appetite, but had lost about 25 pounds in weight on account of her inability to swallow food. Her difficulty in swallowing varied considerably: sometimes, for two or three days, she experienced little trouble; then, for a time, she could swallow only a little fluid, and that with difficulty.

Upon admission, the patient was found to be a large, well nourished woman. The heart, lungs and abdominal organs were apparently normal. A No. 24 bougie introduced into the œsophagus met with an obstruction 15 inches from the teeth and smaller

bougies were all arrested at 16 inches. An X-ray picture, taken after the œsophagus was filled with bismuth, showed a funnel-shaped dilatation above a tapering, narrow stenosis of the tube. The obstruction was believed to be due possibly to a tumor of the cardiac orifice of the stomach, and an exploratory gastrostomy was decided on. This operation was done on November 23, 1906. The stomach was normal, and Kader's gastrostomy was done to put the stomach at complete rest. A month later, a string introduced through the mouth was fished out through the gastrostomy opening, the stomach having first been filled up with water, which was then drawn off with an aspirator introduced through the gastric fistula. The stricture was then divided by the string method, until a No. 33 bougie could be passed, not, however, without some difficulty. A moderate amount of bleeding from the mouth followed this procedure.

Following this operation, Dr. Gibson said, the patient was able to take solid food with comparative ease, but since then there had been a gradual recurrence of the stricture. The presumption was that the growth of the œsophagus was a malignant one. The gastrostomy opening is preserved and functionates perfectly without leakage.

OSTEOPLASTIC RESECTION OF THE SKULL FOR INTRACRANIAL HÆMORRHAGE.

DR. WILLY MEYER presented a young man of twenty years, who on June 17, 1906, was thrown from his horse, striking the macadamized road with his right temple. He was immediately unconscious, and was carried home, where he was treated for concussion for forty-eight hours. Then focal symptoms developed, involving the upper left extremity, especially the hand, the left lower extremity, and part of the left facial nerve, the lower eyelid on that side hanging down. His pulse had gradually grown slower, finally reaching 48 per minute, with a temperature of 102 degrees F. There had been no convulsions. He had vomited on the first day after the accident.

When Dr. Meyer first saw the patient, at the beginning of the third day, he was semi-conscious, and protruded his tongue when he was asked to do so. His pupils reacted; the reflexes were slow. There was involuntary urination and defecation. The case was regarded as one of epidural hæmorrhage, due to injury to the middle meningeal artery.

Operation, June 20, 1906. An osteoplastic resection of the right temporal bone was made, as for neuralgia of the fifth nerve. At five places the superficial portion of the bone was chiseled away, and the skull here drilled with Doyen's instrument, and then opened with the Gigli saw, with the assistance of Braatz's instrument. Underneath the skull flap, a large quantity of clotted blood was found, extending upward toward the motor area. This was scooped out. The bleeding proved to be extradural, and the dura was not opened. The osteoplastic flap was thereupon replaced, using the lower trephine openings for the purpose of drainage.

Immediately after the operation the patient's pulse, which had ranged between 48 and 56 per minute, rose to 72. The focal symptoms slowly subsided. The patient's further recovery was uneventful; he left the hospital on the thirteenth day after the operation. To-day he is entirely well and has resumed his horse-back riding.

Of special interest in the case seems the rise of temperature on the third day after the injury. A consultant was inclined to attribute the same to a beginning meningitis. In Dr. Dawbarn's case, presented a few months ago, a neurologist explained the like observation, as probably due to an irritation of the heart-centre. Dr. Meyer said he did not share these views, but would explain the fever as the so-called "aseptic," so frequently found in cases of uncomplicated fracture.

DR. DAWBARN said, apropos of Dr. Meyer's description of his brain operation, in which he alluded to Dr. Dawbarn's recently reported similar cases, that he is about to publish in the *ANNALS OF SURGERY* [this article was printed in the February, 1907, number] an account of several such operation made safer by means of cording the extremities in such a way as to accumulate in them large quantities of blood. In consequence there is, to mention one advantage only, an anæmia of the brain, comparable to that of natural sleep; and at least sometimes it is possible, the patient once chloroformed as usual, to withdraw this drug, and depend for analgesia wholly upon the factor mentioned. Dr. Dawbarn in this article details two instances for example, in which operations three-quarters of an hour long were performed upon dura and brain without suffering, and without awakening until the limbs were uncorded.

INCOMPLETE INTESTINAL OBSTRUCTION: CÆCOSTOMY
UNDER COCAINE.

DR. WILLY MEYER presented a man, sixty-two years old, who was admitted to the German Hospital on October 31, 1906. About four months ago he began to feel weak, and lost considerable weight. Three weeks ago he began to suffer from nausea and belching and constipation. There had been no vomiting; the patient had never passed any blood. The abdomen was distended, and the patient complained of some pain on the right side. A careful examination revealed a mass in the left inguinal region. A rectal tube was introduced, which met with an obstruction about 8 inches above the anus. Peristaltic motion was visible through the abdominal wall, and there was a pronounced gurgling sound on auscultation. An examination of the blood showed advanced leukæmia, and the spleen was considerably enlarged.

On November 2, 1906, under local cocaine anæsthesia, the abdomen was opened. The large intestine, much distended, presented. The cæcum was pulled forward and attached to the peritoneum by means of a continuous suture. After carefully protecting the surrounding parts, a very small incision was made into the gut, giving exit to a large quantity of gas and thin, yellow faecal matter. A good-sized, stout rubber tube, which effectually prevented leakage, was then introduced into the gut, and a permanent cæcostomy wound thus established. To make a water-tight canal according to the Kader-Gibson method seemed contra-indicated in view of the tremendous bowel distention.

The patient made an uneventful recovery from the operation, and his general health had gradually improved. He still wears his tube, which drains, almost water-tight, into a medium-sized glass bottle, which he wears within one leg of his trousers, properly fastened. The stool within the cæcum is kept liquid by daily administration of a small dose of aperient water. There arrive frequent normal defecations per anum. The mass in the left inguinal region has not diminished in size. Patient is opposed to further operating.

The case was apparently one of incomplete intestinal obstruction, due possibly, in view of the result of rectoscopy, to lymphoid infiltration of the walls of the bowel. The patient had never passed any blood or mucus in the stools. The number of leucocytes ranged from 130,000 to 180,000.

DR. GIBSON said that in one case of acute intestinal obstruction of the hepatic flexure resulting from adhesions produced by an empyæma of the gall-bladder, he had resorted to a valvular cæcostomy after the method he has recommended with very satisfactory results. The tube in that case could be readily withdrawn, and it was removed permanently at the end of nine days. The speaker said he had also found this a satisfactory procedure in other cases of intestinal obstruction.

DR. MEYER said that his reason for making the fistula not water-tight in this case was on account of the enormous distention of the gut. Even with the very small incision that he made into the gut there was a tremendous gush of fæcal matter, which would have rendered the proper protection of the peritoneal cavity difficult had the gut been opened primarily, as is necessary in the Kader-Gibson cæcostomy.

ABDOMINAL SECTION FOR PERICOLONIC PERITONEAL ADHESIONS.

DR. WILLY MEYER presented a man fifty-eight years old who had long suffered from constipation. When he came under observation, on November 17, 1906, he stated that he had lost more than 20 pounds in weight during the past few months, and that since February, 1906, he had suffered from frequent attacks of pain, starting from the middle of the transverse colon and passing down to the sigmoid flexure. He also had occasional attacks of severe cramp-like pain, with rumbling sensations over the entire abdomen. His stools consisted of small, round masses, resembling the fæces of sheep. A rectoscopic examination was negative; also repeated palpation. A blood examination was normal.

An exploratory operation was requested by the patient, and this was done on November 17, 1906. Upon opening the abdomen by means of a small incision, the introduced hand could not feel a tumor anywhere, but upon lengthening the wound for the purpose of inspecting the colon, a number of broad, fan-shaped adhesions were found springing from the parietal peritoneum, surrounding the mesocolon and mesosigmoid, pulling the gut aside, and constricting its calibre. These adhesions were divided between double ligatures until the entire gut was freed. The abdomen was then closed.

The patient had improved greatly since the operation,

although he complained off and on of slight pains in the region of the sigmoid.

THE OPERATIONS FOR NEOPLASMS OF THE TONGUE.

DR. JOHN ROGERS read a paper with the above title, for which see page 553.

DR. F. KAMMERER said he did not quite agree with the reader of the paper as to the advisability of attempting all these operation from the mouth, excepting in those cases where the tumor was still rather small and situated at the border of the tongue. Whether in such cases glands could be felt or not the speaker said he always began the operation with an incision below the inferior maxilla of the affected side, resembling the old Kocher incision for extirpation of the tongue, perhaps supplementing it with a second incision in a downward direction along the anterior border of the sternomastoid muscle. He then extirpated all the glands and the salivary glands in the submaxillary and carotid triangles, and it had been his practice always to ligate the lingual artery. Then it was generally possible to remove the growth with a wedge-shaped excision. The speaker did not think it necessary to remove the entire half of the tongue anterior to the tumor.

Dr. Kammerer said that the moment these malignant growths of the tongue had extended beyond the confines of that organ, one of the bone-cutting operations was indicated. When the disease had invaded the floor of the mouth, he preferred the Langenbeck incision, and in those cases he usually made a bayonet-shaped cut through the bone, which he thought was best suited to hold the bone in place afterwards. When the tumor had invaded the soft palate and perhaps the tonsil, he preferred the Mikulicz procedure of extirpating the ascending ramus of the jaw. In advanced cases, the speaker thought that method gave even a better access to the affected parts than did that of Langenbeck. In both of these operations, it was advisable to tie the external carotid as a preliminary measure.

Dr. Kammerer said that within the past few years, after seeing Kocher do his modification of the Sédillot operation of median section of the lower jaw, he had tried it on a few occasions. Where the tumor was situated near the tip of the tongue, the operation seemed to him certainly a good one, but he had had

difficulty in removing growths by this method that were situated far back in the mouth, and did not consider the method as convenient for these cases as those of Langenbeck and Mikulicz.

The speaker said that in operating on these cases in former years, he had occasionally resorted to a preliminary tracheotomy, and his results, in common with those of other surgeons, were not encouraging. That this procedure increased the danger of pneumonia was generally conceded and the speaker had himself lost two cases of extirpation of the tonsil in former years from this cause.

DR. CHARLES L. GIBSON said that in cases of advanced epithelioma of the tongue, involving the neck and necessitating some form of division of the bone, he thought the operation was best done in two stages. A preliminary tracheotomy he deemed unnecessary and painful, as the same object could be accomplished by administering the anæsthetic through a tube introduced through the nostril or mouth, and surrounded by packing. With preliminary ligation of the external carotid there was practically no bleeding.

As regarded the choice of operation, the speaker said he thought the Sédillot incision now recommended by Kocher gave the best exposure when the tonsil or pharynx was involved. No matter which method was employed, however, the final results, in his experience, had not been good. In most of the cases upon which he had operated, the disease was far advanced. He could not recall a single instance in which immunity from recurrence had been enjoyed as long as in the case shown this evening by Dr. McWilliams. It was a curious fact, Dr. Gibson said, that patients who were suffering from such a malignant and distressing condition as cancer of the tongue should so frequently allow the condition to progress to an inoperable and hopeless stage.

Dr. Gibson called attention to the fact that the raphé of the tongue practically divided the organ into two separate parts, and he inquired of Dr. Rogers what effect that would have upon the blood supply in attempts to save the tip of the tongue in exsecting the median portion of one-half of the tongue.

DR. WILLY MEYER said that the original Kocher operation, which seemed to have been abandoned, could be improved to a great extent if we divided the anterior belly of the digastric muscle. By the original method, that muscle had usually been preserved.

The speaker said that in a case of carcinoma of the tongue upon which he operated in 1897, where the diagnosis was confirmed by the microscope, he did a preliminary tracheotomy and then followed the Kocher method, thoroughly dividing the anterior belly of the digastric, drawing the tongue forward and extirpating about three-fourths of the organ, and extending the incision as far down as necessary to the hyoid bone. Then the tip of the tongue, which had been preserved, was turned back, and stitched to the remaining part. Of course the lymphatic glands had also been carefully removed. That patient was still alive to-day; he was able to talk well, and had no indications of a recurrence.

Dr. Meyer also referred to a case of sarcoma of the tonsil, which had invaded the pharynx, soft palate and tongue in a young man whom he showed at a meeting of the Surgical Society in 1890. In that case he operated by the Mikulicz method, dividing the floor of the mouth and removing the tonsil, entire tongue and part of the pharynx. In all these extensive bone operations, the speaker said, he regarded ligation of the external carotid as preferable to the lingual.

In regard to the administration of the anæsthetic in these cases, Dr. Meyer said, the introduction of a tube through the mouth or nostril, as mentioned by Dr. Gibson, was an excellent plan in cases where the growth was favorably situated. Where a preliminary tracheotomy was deemed essential, the occurrence of a subsequent pneumonia could possibly be averted by inserting a tracheal tampon cannula, and packing above, leaving the latter in place for forty-eight or fifty-two hours.

The extirpation of the glands was a very essential adjunct to these operations on the tongue, and the speaker said he could recall at least two instances where a recurrence took place in the glands posterior to the sternomastoid, and they had impressed upon him the importance of cleaning out the entire chain of glands, both anterior and posterior, from the sternomastoid to the base of the skull.

In speaking of the after-treatment of the wound following removal of the tongue, Dr. Meyer said he thought it should be left entirely open. He recalled one case where death occurred on the eighth day, due to sepsis, where the internal wound after extirpation of the tongue was closed up to an opening large enough to give exit to the gauze and tampons.

DR. L. W. HOTCHKISS said that in dealing with these cases of epithelioma of the tongue he was glad to hear the emphasis that had been placed by the previous speakers upon the importance of extirpating the glands, because he had been impressed with the relative frequency of recurrence in the posterior chain of cervical glands.

The speaker said that so far as his personal experience with these cases went, he was rather inclined to favor the Whitehead operation through the mouth, with extirpation of the cervical glands as widely as possible on the side of the cancer. In the more extensive cases, with involvement of the tonsil, Dr. Hotchkiss said he had done the operation in two stages, as suggested by Dr. Gibson, first extirpating the glands and tying the external carotid, and at a subsequent period doing a suprahyoid pharyngotomy by the Mikulicz method and completing the operation.

In order to emphasize the importance of extirpation of the glands in practically all cases, Dr. Hotchkiss cited one instance where a small epithelioma of the tip of the tongue in a woman was removed by a V-shaped incision and without gland excision. Within a few months the patient returned with an inoperable involvement of both sides of the neck. He could recall two cases of apparent recovery after operation through the mouth. In one of these cases, two and one-half years had now elapsed without any signs of a recurrence. In this case the cervical glands were also excised. The other case was operated on three and one-half years ago at Bellevue Hospital by the Whitehead method, without preliminary ligation of the external carotid or extirpation of the glands, and in this case three years had elapsed without any evidence of a local recurrence; but the glands of the left side of neck were removed a few months ago and reported epitheliomatous. This patient is in good condition after the secondary operation, and three and one-half years have elapsed since primary operation.

DR. JOHN B. WALKER said his experience coincided with that of the other speakers, that a recurrence in these cases was very apt to occur in the posterior glands. The speaker said that in a case operated on seven years ago, he removed a small epithelioma on the side of the tongue, together with the sub-maxillary glands, and there had been no recurrence up to the present time.

In connection with the proper feeding of these patients, Dr.

Walker said it was his custom to educate them in the use of the stomach-tube by instructing them to pass it daily for several weeks prior to the operation. Through a small rectal tube and a 3-ounce funnel they were first shown how to introduce water into the stomach, and later milk or gruel, and this knowledge proved of considerable value to them in their proper feeding after the operation.

DR. JOSEPH A. BLAKE said that in three cases of epithelioma of the side of the tongue, with involvement of the floor of the mouth and the jaw, he had removed the mandible, and in that way obtained a beautiful exposure of the parts, enabling him to remove the entire carcinomatous mass, together with the lymphatic nodes. Another advantage of this method was that the wound could be closed more perfectly, the mucous membrane of the cheek being sutured to that of the remaining portion of the tongue. In all the cases in which he had done this operation, which might be considered as an extension of that of division of the jaw, the patients had made a very smooth convalescence. In two of his cases, three years and four years had elapsed without a recurrence. The remaining mandible was held in place for about ten days following the operation by an interdental splint which had been made and fitted prior to the operation.

DR. CHARLES H. PECK, in speaking of the liability of involvement of the posterior glands, said that seven months ago he had removed an extensive epithelioma of the tongue, at the same time cleaning out the submaxillary triangle. A local recurrence was confidently expected, but instead of that the patient now had a mass as large as a hen's egg along the posterior border of the sternomastoid muscle.

Dr. Peck said he had had one experience with the Sédillot operation which proved unsatisfactory, as the severed jaw failed to unite, even after wiring and the introduction of an intradental split. The speaker said he had always ligated the linguals in operating on extensive epitheliomas of the tongue, in preference to ligation of the external carotid. The ligation was not difficult, and in one instance he was able to reach the opposite lingual through a curved incision.

DR. JOHN A. HARTWELL said that in one case similar to those referred to by Dr. Blake, the introduction of an intradental plate worked very well. In this case, however, there was an early

recurrence. As a last resort, trypsin, much stronger than the commercial preparation, was used with absolutely no effect.

DR. KAMMERER said he had also seen non-union of the jaw occur after the Sédillot operation in one case, although the bone had been carefully sutured.

DR. GEORGE WOOLSEY said that in his own experience he could not recall a single case of epithelioma of the tongue where the patient survived the three-year period. In nearly all of the cases that had come under his observation, the patients were in a desperate condition, and usually gave a history of having had previous minor operation. The speaker said that he, in common with other surgeons, had to plead guilty to the charge of at times acceding to the urgent request of patients to try conservative measures in the treatment of this condition, which demanded a radical operation because of its extreme liability of recurrence.

In reply to the query raised by Dr. Gibson as to the possibility of necrosis of the tip of the tongue after the ligation of one lingual, Dr. Woolsey said he did not think that was very likely to occur, as there was a good deal of anastomosis between the vessels of the two sides of the tongue—sometimes altogether too much, and he recalled one case where the patient bled to death after the ligation of one lingual. In that case there was an anomalous distribution of the artery. Dr. Woolsey said that in dealing with these cases he had been in the habit of ligating either the lingual or the carotid, and in one desperate case where he extirpated both carotids, he left a small section of the tongue, which subsequently sloughed.

As to the choice of operation, the speaker said that with the exception of the very favorable cases, he had usually resorted to the Kocher method, with median division of the jaw. He had never observed a case where union had failed to occur. He had never resorted to tracheotomy excepting in one case where it became imperative in order to save the patient from dying during the etherization. The speaker said that years ago, while on a visit to Billroth's post-mortem room in Vienna, he saw three cases of epithelioma of the tongue that had died of septicæmia after the operation, and these three deaths had occurred within two weeks.

Dr. Woolsey said he regarded the feeding tube as a very valuable adjunct to the after-treatment of these cases.

DR. ROGERS, in closing, said the more he saw of malignant disease the more he became convinced that certain patients would rapidly succumb to it, no matter what was done for them. The case shown by Dr. McWilliams, where there had been no recurrence after an operation for epithelioma of the tongue four years ago, was certainly an interesting and unusual one. The speaker said he agreed with Dr. Woolsey that necrosis of the tip of the tongue was not apt to occur after ligation of the lingual artery. He recently saw an epileptic who had bitten through the centre of his tongue, dividing both linguals, and the wound was closed by simple stitching without any subsequent trouble.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting held January 7, 1907.

The President, JOHN B. ROBERTS, M.D., in the Chair.

FRACTURE DISLOCATION OF THE ATLAS WITHOUT SYMPTOMS OF SPINAL CORD INJURY.

DR. H. AUGUSTUS WILSON exhibited a man, a railroad brakeman, who fell from a train while it was moving at about ten miles an hour, striking upon his left shoulder and cheek. Fearing that he would be run over he forcibly wrenched or twisted his head and shoulders. He did not lose consciousness. During the first two weeks thereafter he did not manifest any symptoms as a result of the fall except some little soreness over his left malar bone and his left shoulder. Two weeks after his accident he began having dull dragging pains about his neck. He continued his occupation as brakeman without interruption for one year. During this year, with the exception of the first two weeks, he was under the care of several physicians for vague symptoms which were considered rheumatic in character and were not ascribed to the fall. At various times during the year, plasters, liniments and ointments were applied to his neck without apparent effect.

During the next year and a half—that is, up to two and a half years after he fell from the train—he worked about three-fourths of the time. During the several periods when he did not work he suffered with pain in his neck, but was otherwise competent to work. Patient said that the jarring and jolting of the train did not increase his pain. Three years after the accident the pain in his neck became more severe and constant, compelling him to

discontinue his work, which he has not resumed up to the present time. The patient states that an abscess of the neck was diagnosed and an attempt was unsuccessfully made to aspirate it. A few months later he fell into the hands of an osteopath who told him that he had dislocation of the seventh cervical vertebra, and treated him for thirteen weeks. One of the methods resorted to was to suspend the patient so that his feet did not touch the floor; while in this position the head was forcibly rotated. He states that at one of his examinations quick forcible pressure was made upon the top of his head while he was standing. He immediately dropped to the floor and was momentarily unconscious.

In June, 1905, he was brought to the Orthopedic Department of the Jefferson Hospital. A steel brace was applied to remove the weight of the head from the spine and immobilize the neck. This he has worn constantly until the last two months. He has recently taken off the apparatus for an hour at a time every morning and afternoon, without disadvantage. His present condition is that of a well-nourished white man. The mucous membrane of the mouth is of natural color and appearance. No abnormalities of the superficial or deep reflexes. No disturbance of sensation, or other nerve function. Gait is normal. With the stiff supporting brace removed he carries his head in a somewhat stiff, unnatural manner.

Special Senses.—*Eye examination* by Dr. Wm. M. Sweet. Pupillary reflexes. Media clear, optic discs clearly outlined, and retinal vessels of normal calibre and direction. No defect of ocular rotations. Other fields of vision show no contraction.

Throat examination by Dr. J. L. Harkness, finds he has a subacute rhinitis, intumescent turbinates, relaxed and injected soft palate, and the pharynx bulges forward below the line of the uvula, apparently narrowing the œsophageal and laryngeal openings. Otherwise the pharyngeal conditions appear normal.

Physical Examination of the Neck.—Inspection from a directly posterior standpoint does not reveal any manifest irregularity. On view laterally, the patient's head is observed to be inclined forward and with the chin elevated apparently in the same position in which it was held by the brace. Surface at the back of the neck is observed to have its concavity posteriorly and an elevation above and below. The Adam's apple is not unduly conspicuous.

Palpation of the tumefaction above referred to shows that it is hard and immovable, not painful on pressure. Pressure in the depression just below the occiput elicits pain, but not of a severe type. The guarded manner in which the head is constantly held renders it difficult to determine the amount of motion at or above the seat of the injury. Definite knowledge as to the mobility of the upper spine was not considered of great importance. The risk of subjecting the patient to the accompanying trauma rendered it inexpedient to determine the extent of mobility.

The X-ray plate (Fig. 1) shows a fracture of the odontoid process and a forward dislocation of the atlas, which occupies a tilted position. Until recently the patient was unable to sleep in recumbency, but could do so sitting on a chair with his head forward on a pillow. Occasionally he has difficulty in swallowing because of the mechanical displacement of the œsophagus.

DR. JAMES K. YOUNG said he had seen a similar case in a child who fell and dislocated the second cervical vertebra. With the injury there was loss of power and sensation in the lower extremities. The remarkable feature in Dr. Wilson's case is the absence of cord symptoms. From the history of the case he would consider it one of spondylitis following injury, this injury possibly being dislocation and spontaneous reduction; now there is dislocation as a result of the spondylitis.

DR. GEORGE G. ROSS mentioned a case of fracture of the bodies of the tenth and eleventh dorsal vertebræ and bowing of the spinal column without paralysis. The accident occurred in July; the patient when on a hay wagon catching his head and bending over, compressing the bodies of the vertebræ and springing apart the spinous processes. This formed a distinct ridge over which ran the cord, but there was neither permanent motor nor sensory symptoms. The diagnosis was confirmed by the X-ray.

DR. GWILYM G. DAVIS said that recovery from injuries of the vertebræ in the cervical region are more frequent than is generally supposed. He has seen several cases end in recovery even though deformity was marked.

DR. WILSON, in closing, said the man was very clear in his description of the accident and stated that the symptoms were not such as to demand the care of a physician until after two weeks. The railroad physicians in the relief bureau did not consider the case worthy of attention, hence the symptoms must have



FIG. 1.—Fracture dislocation of the atlas.

been very trivial. He believes the great deformity followed the "osteopathic treatment." The symptoms were so aggravated by it that the man could not lie down, being obliged to sit with his head forward. During part of the time he walked the street night after night. There probably was some displacement originally, but that method of treatment increased it.

TENDON TRANSPLANTATION.

DR. HENRY R. WHARTON exhibited a child aged twelve years, who, when three years of age, had sustained a fall, injuring the spine. Paralysis of the entire left side followed, and the patient was confined to bed for three months. The arm gradually improved, and the function was restored to normal. The leg improved, but with a persistence of muscular atrophy, and an equinus valgum. At the Presbyterian Hospital, in July, 1906, Dr. Wharton had performed the following operation:

The tendo Achillis and peroneus longus and brevis tendons were divided subcutaneously and the tendon or the tibialis anticus was exposed and divided. The tendon of the extensor longus digitorum was next exposed and divided and the proximal end of this tendon was sutured to the distal end of the tendon of the tibialis anticus. To overcome the dropping of the great toe the tendon of the extensor proprius pollicis was exposed and divided, and after exposing the tendon of the peroneus tendon it was divided and sutured to the distal end of the tendon of the extensor proprius pollicis. The wounds were closed and the limb put in a position of over-correction in a plaster of Paris bandage. Later, a brace was fitted and the patient was allowed to walk upon the limb.

DR. JOHN H. JOPSON, who assisted Dr. Wharton at the operation, said the patient showed extraordinary improvement, the foot previously being a useless member. He now resorts to this type of operation with a great deal of confidence. The main element of success is the selection of cases. In those with good muscles to utilize for transplantation, the results will be good. If complete paralysis be present, operation will result only in disappointment; those cases should be let alone, so far as transplantation operations are concerned.

RECOVERY FROM SELF-INFLICTED COMPLETE SUBHYOID
LARYNGOPHARYNGOTOMY.

DR. JOHN H. JOPSON and DR. GEORGE C. STOUT showed a patient recovered from self-inflicted complete subhyoid laryngopharyngotomy. He was an adult aged forty-seven, admitted to the Presbyterian Hospital three months previously, suffering from shock and loss of blood. Two hours before he had cut his throat, and the wound extended from one sternomastoid muscle to the other, dividing the skin, the subcutaneous and the muscular tissue of the thyro-hyoid space, the pharynx being opened to the full extent of the wound. The epiglottis was cleanly severed at its attachment to the thyroid cartilage, drawn upward and turned backward out of sight. A small piece of the upper border of the thyroid cartilage was sliced off on either side. The false cords were not injured, the weapon having passed just above them. After reaction, which quickly followed, the patient was etherized through the wound in the neck. The epiglottis was drawn downward and forward and sutured to its place of former attachment by three sutures of No. 1 chromicized catgut passed through its entire thickness and through the thyroid cartilage, which was partly ossified. One suture passed through the median line and one was placed on either side. These sutures held the epiglottis in excellent position, and were reinforced by sutures passing through the superficial structures and perichordium. The lateral angles of the wound in the pharynx were then tightly closed by chromicized suture and the entire wound closed by deep and superficial stitches. Following operation, the patient did very well. There was considerable laryngeal irritation for some days, shown by cough and free expectoration of mucus and suppression of voice. The temperature was slightly elevated for ten days. There was a slight superficial suppuration at a couple of points. At no time were there evidences of œdema or respiratory obstruction. Inhalations of benzoin vapor were instituted. There was a gradual restoration of voice after ten days. Twenty-four days after operation it was noted that laryngoscopic examination showed the epiglottis to be in good position as far as its attachment was concerned, and leaning backward somewhat more than normal. The voice was then quite strong and is now normal. Recovery is now complete.

DR. ASTLEY P. C. ASHHURST said that he desired in this

connection to report a case of self-inflicted suprahyoidean pharyngotomy, with fatal result, because it did not seem fair to let it pass unrecorded when the successful case of Drs. Jopson and Stout was being published. On January 5, 1906, Dr. Ashhurst was called to the Orthopædic Hospital to see a nervous patient who had suddenly gone insane and had produced a large wound in his neck by sawing it with a broken bottle which he had prepared on purpose. Before Dr. Ashhurst reached him, the patient had been given morphin and an intravenous injection of saline solution; and to this treatment it was probably due that he had not died at once. The trachea and larynx were found wagging back and forth in the wound, the patient being speechless, nearly apnœic, and almost exsanguinated. High tracheotomy was immediately performed, and respiration being thus somewhat restored, the wound was examined. It extended from one angle of the jaw to the other, grazing the anterior surface of the larynx, passing between the hyoid bone and the jaw, and opening the pharynx widely between the epiglottis and the base of the tongue. Seven or eight bleeding points were ligated, including the right lingual artery. A nick in the right internal jugular vein was sutured. The right hypoglossal nerve was divided just below the mylohyoid muscle; but as its cranial end could not be found winding around the origin of the occipital artery, search for it was finally abandoned. The base of the tongue was then sutured to the muscular wall of the pharynx with mattress sutures of chromic gut; the depressor muscles of the jaw were sutured to those of the floor of the mouth, and the skin was closed, with drainage from each angle. The next day the temperature was 103 degrees F., and the following day 105 degrees F. By the third day it had fallen to 101 degrees F., and there appeared some hope of recovery. After consultation with Dr. W. J. Taylor and Dr. Morris Lewis, the tracheotomy tube was removed, and the patient in reply to a query said he felt "as fine as silk." He breathed fairly well through the larynx for about fifteen minutes, then became cyanosed and had an attack of coughing. Although the tube was at once replaced, voluntary respiration was not restored. Artificial respiration, and mouth-to-tube insufflation were practised, but fifteen minutes after the heart had ceased to beat the patient was abandoned as dead. This was seventy hours after the operation.

CERVICAL RIB.

DR. JOSEPH M. SPELLISSY exhibited a seventh right cervical rib, with photographs and skiagraphs of the anomaly before its excision, and presented the patient, a girl of twenty years, from whom it had been removed. An accident, a year before the patient applied for advice at the Orthopædic Department of the University Hospital in the service of Dr. DeForest Willard, was followed by deformity of the right shoulder. Examination not only discovered a sternal luxation of the right clavicle, but the presence of a right seventh cervical rib. An X-ray plate made by Dr. William R. Pancoast confirmed the diagnosis. The rib was excised, but not without difficult dissection. The subclavian artery passed over the middle of the cervical rib, resting in a deep groove. The distal end of the cervical rib articulated with the upper surface of the first dorsal rib. This articulation was disarticulated. The artery was dissected free some 2 to 3 inches and looped over the distal end of the cervical rib as an umbilical cord is slipped over a foetal head. The distal end of the cervical rib was now raised above the artery, freed from attachments, and disarticulated from the seventh cervical vertebra. The subclavian vein was not seen, and no abnormality was noted in the circulation of the right arm.

The specimen was pronounced the most perfect in the experience of Dr. W. W. Keen and of Dr. W. R. Pancoast.

PYRALIN AS A COVERING FOR METAL BRACES.

The use of pyralin dissolved in acetone and painted on stockinette as a fixed dressing by J. K. Young, suggested some years ago to Dr. Spellissy its probable suitability as a covering for metal braces. Its experimental use by Dr. Spellissy had verified his anticipations. He exhibited a spine brace so covered, that had been to Brazil and had required no recoating except where alterations obliged by the growth of the patient necessitated it. The pyralin is applied like paint, with a brush—or preferably by dipping—and in successive coats.

The finish is improved by the rubbing down of each coat with sandpaper and later with pumice stone.

CIRCUMCISION.—A PLASTIC IN CONSTRICTED PREPUSES.

DR. OSCAR H. ALLIS demonstrated the technic of an operation devised by him, and read a paper descriptive of it, for which see page 610.

REMOVAL OF A KNITTING-NEEDLE FROM AN ABDOMINAL ABSCESS.

DR. W. E. LEE reported the following case: An unmarried woman, twenty-four years of age, was admitted to the Pennsylvania Hospital December 28, 1906, with the diagnosis of iliac abscess. She gave a history of an indefinite illness of six weeks' duration, and it was not until after the operation that the true history was obtained. In June, 1905, she had reason for suspecting herself pregnant and applied to an old woman for help. With the patient standing, the right knee flexed and the foot resting upon the seat of a chair, and without raising her clothes, this woman took a bone knitting-needle from a nearby table and introduced it into the vagina with the right hand. This was followed by profuse bleeding which continued for several days. There was the normal flow at the next menstrual period, which has recurred regularly ever since. Several weeks after the operation the patient noticed a definite spot of tenderness in the right side close to the pelvic bone, which prevented the wearing of corsets; aside from this she has suffered no inconvenience from the operation.

On admission, her temperature was 99.2 degrees F., pulse 100 and respirations 24. There was a distinct bulging of the abdominal wall in the lower right quadrant, caused by a firm, tense, intra-abdominal mass and a superficial fluctuating tumor about the size of half a walnut, $\frac{1}{2}$ inch above and $\frac{1}{2}$ inch to the median side of the anterior superior spine of the ilium. This mass was first noticed three days before her admission to the hospital.

General anæsthesia was induced with ethyl chloride and the superficial fluctuating tumor opened, evacuating a few drops of pus. At the bottom of this abscess cavity a hard, sharp substance was found; this proved to be a piece of the bone knitting-needle, $4\frac{1}{2}$ inches in length. The needle came from a small sinus leading down into the pelvis.

A vaginal examination, made three days after the operation, showed a small uterus in the mid position, with the cervix pointing toward the right vaginal wall and the fundus pushed far over to the left side of the pelvis. There were no abnormal openings or scars in the vaginal walls and the cervix was normal except for a thin opaque discharge which escaped through the cervical canal.

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ORIGINAL MEMOIRS.

SEVERE BURN OF TOP OF HEAD AT SEVEN MONTHS OF AGE, FOLLOWED BY NECROSIS OF ENTIRE OSSEOUS CAP OF CRANIUM.*

AT FOURTEEN YEARS OF AGE DETACHMENT OF THE ENTIRE CALVARIUM BY CIRCULAR CRANIOTOMY FOR EPILEPSY AND DEFECTIVE MENTAL DEVELOPMENT.

BY WILLIAM WILLIAMS KEEN, M.D.,

OF PHILADELPHIA.

Professor of Surgery in the Jefferson Medical College.

HARRY H. W., æt. fourteen, was admitted to the Jefferson Medical College Hospital, December 7, 1904, at the request of Dr. W. F. Haines of Seaford, Del., with the following history: At seven months of age his parents left him wrapped up in a shawl in a rocking chair in front of a wood fire, which then consisted chiefly of coals, while they went to attend to some farm work. They also left an older child, about two years of age, to take care of him. They were absent from the house for about forty-five minutes. Upon their return they found that the baby in the rocking chair had begun to cry and the two-year-old child had tried to climb into the rocking chair to comfort him. In doing so the chair was overturned forward and the baby thrown into the fire, so that the top of the head was in contact with the live coals. As nearly as can be ascertained by cross-questioning the two-year-old child, and knowing the length of their own

* Read before the Philadelphia Academy of Surgery, February 4, 1907.

absence, the baby's head lay in the coals not less than twenty and it may have been thirty minutes. As a result of this severe burn, the scalp being thoroughly charred, the whole top of the head sloughed off about six months later, including a large portion of both frontal bones, the two parietal bones in their entirety, and a part of the squamous portion of the right temporal bone. The piece of the squamous bone was lost, but a photograph (Fig. 1) shows the other four pieces of bone their natural size. The four pieces of bone which have been preserved can easily be identified. They are of a dark brown color, the result both of the burn and suppuration. Placing them in position, they measure from front to back 17 cm., and from side to side 11 cm. When the bone sloughed away the dura was exposed, covered by that time with granulations. A year after the burn, the scalp was healed, and upon my recommendations (for Dr. Haines showed me the specimens and consulted me at that time) a tin cap covered with silk was made for the purpose of protecting the top of the head from blows, but it could not be used as it annoyed the child. Six months after cicatrix was complete, the scar broke down, and from that time till the present it has been alternately healed and open.

Soon after the accident he had nine convulsions. He was then free from them for over a year. Then he began to have distinct epileptic attacks. These have continued ever since and have increased in severity and frequency. They occur day and night regardless of any known influence, such as excitement, the direct sun's rays, etc. On an average, his father thinks he has about 400 attacks every year. Sometimes he goes several days without a spasm.

He began to go to school at seven years of age and appeared to learn rapidly. His memory was excellent till he was about eleven years old, when his epileptic attacks became more frequent and he became stupid. He was, therefore, removed from school, and he has forgotten most of what he learned and is becoming more and more deficient mentally. While at school he learned to read and write, but in the last three years he has lost the ability to do either.

Physical Examination on Admission.—He seems to be physically a well-developed boy of average height and weight, but his face presents a dull and stupid appearance. He responds rather

FIG. 1.



Photograph of the necrosed frontal and parietal bones, natural size, and measuring when approximated, 17 x 11 cm.

FIG. 2.



Photograph of the boy at 14 years of age.

FIG. 3.



Photograph of top of head. The dark line corresponds to the present opening in the bone and measures 8 x 5 cm. The original opening when the bones sloughed away at 13 months of age measured 17 x 11 cm. (see Fig. 1). While his head has increased in size with his growth, the defect in the skull has contracted 9 cm. antero-posteriorly, and 6 cm. transversely.

FIG. 4.



Skiagraph (Jan. 10, 1905) showing the gap left in the bone by the complete circular subcutaneous craniotomy. Note also the evidence of loss of bone on top of the skull

indifferently to questions and talks, but can hardly be said to converse.

His heart, lungs, and abdominal viscera are, apparently, normal. The deformity of his skull is very marked (Fig. 2), showing a deep furrow a little to the right of the middle line, running obliquely from behind forward and to the right. On the top of the head there is a very large scar (Fig. 3). The oval line in this photograph is an ink line showing the present area under which there is no bone. This measures only 8 by 5 cm. Corresponding to this oval line the margin of the bones can be felt quite distinctly; under the scar, pulsation of the brain can be seen; pressure on the area where there is no bone causes pain. There is also a scab at two or three ulcerated points. The scalp is as tense as a drum head over the entire top of the head.

His convulsions as observed in the hospital were at times chiefly manifested in the left leg and arm, at other times in all four extremities. There was no localization of the convulsions.

Urine: turbid, straw-colored, 1017, reaction acid, no albumin or sugar was found, urea 1.6 per cent.; no crystals, but amorphous urates, squamous epithelium, and a few leucocytes; no blood or pus. Dr. Wm. M. Sweet examined his eyes and reported as follows: Normal pupils; normal ocular movements. Optic nerves good color, vertically oval. Arteries and veins normal; smaller twigs tortuous. The arteries in the right eye-ground are a trifle small in proportion to the veins.

Dr. Bochroch examined him from the neurological standpoint and reported as follows. Knee jerks are equal; no asteriognosis; no Babinski; no ankle clonus; no impairment of sensation below the knees and no impairment of the muscle sense. No trophic ulcers; he stands equally well on both legs. There are ecchymotic spots on the arms, impeded circulation, cold sweaty hands; the radial arteries suggest hardening. The left hand, which was also burnt, is smaller than the right. The grasp is equally good in both. No atrophy of shoulder girdle muscles. No thermal anæsthesia. Pupils respond to light and accommodation. High arched palate; fairly good dentition. Hears the ticking of a quiet watch at about ten inches. Tendency to nystagmus laterally with the pupils turned to the right. No impairment of the sensation of taste.

After considering the possibility of doing any operation on

the top of the head, I decided that that held out little hope of relief from the pressure, and as the covering of the top of the head consisted of the dura and scar tissue intimately adherent together, it would be very dangerous and probably fatal to attempt any operation there. Moreover, I supposed that probably the superior longitudinal sinus might be blocked as a result of the burn.* I decided, therefore, to do a complete linear craniotomy, so as to separate the entire top of the skull from the lower portion. To do this by an open incision of the entire scalp would almost certainly produce gangrene of the scar tissue of the top of the head. I therefore decided to make several incisions, say 4 to 5 cm. above the ears, and then by my craniotomy forceps to gnaw away a portion of bone about 7 mm. in width. I found that the scalp moved loosely over the skull at about the level indicated all around the skull, excepting at a small area over the right temple. I could, therefore, by undermining it, detach the scalp from the skull through the small openings and then, having made a small trephine opening in the bone, could detach the dura from the bone and do the linear craniotomy.

Operation, December 14, 1904.—I carried out my plan as above described, making the first incision a little back of and above the left ear. I got along without trouble (excepting that it was tedious on account of having to do a large part of the operation without the aid of sight) till I reached the middle line of the forehead. Here, unfortunately, the superior longitudinal sinus was caught in the bite of my rongeur and torn. I immediately checked the quite violent hæmorrhage by some iodoform gauze, extended the incision somewhat across the forehead to the left, rapidly made a trephine opening at this point and gnawed away the bone till I reached the point of the tear. I was able then by my finger to check the flow of blood sufficiently to see the bone well, and complete the craniotomy in the middle line. I packed some iodoform gauze into the opening, which effectually checked the hæmorrhage, and then discontinued the operation, having completed nearly one-half of it, and determined to do the other half a few days later.

In thinking over the matter I feel quite clear that the tear of the sinus was due to the fact that I did not adopt the proper

* The operation showed that this was not the case.

method in approaching this portion of the bone. I should have continued the gnawing away of the bone till I reached almost to the middle line, then have made a trephine opening on the left side and gnawed away the bone on that side nearly to the median line, have exposed the sinus, and then by guarding it with my forefinger or some other suitable shield, such as the handle of a knife, I am quite sure I could have removed this piece of bone which projected inward more deeply than usual, at least 4 or 5 mm., with safety and I would not have torn the sinus.

December 20, 1904.—He has done so well that I completed the craniotomy to-day. Warned by my former experience, I attacked the superior longitudinal sinus posteriorly first from one side and then from the other, as just described, gnawing away the bone over the sinus itself last and without any trouble. The hæmorrhage was not at all severe. Eight incisions were made in performing the complete craniotomy.

Two days after the first operation, and one day after the second, he was sitting up in bed with a backrest. In the interval between the two operations he had two convulsions, December 18 and 19, with but very little twitching. Before the second operation was done it was clearly noted by the resident, his father and several surgeons who had seen him repeatedly, that his mental condition seemed to be distinctly improved even by the first operation. I hardly think that the wish was father to the thought, but, of course, it is difficult to express an unprejudiced judgment. The boy himself said that his head felt much better than before the operation. Very little pain followed either operation. His temperature after each operation only once exceeded 100 degrees.

January 9, 1905, a skiagraph was taken (Fig. 4.) This shows well the absence of bone on top of the head and also the line of my linear craniotomy.

On January 10, 1905, just before his discharge, Dr. Bochrach again examined him and made the following report: The patient's face expresses apprehension and lack of intelligence. A considerable interval elapses between his answers to such questions as "Where do you live?" "How many brothers and sisters have you?" etc. There is apparently no paralysis of the muscles of the face; he is, however, unable to draw his cheek from either side in order to show his teeth. Most likely this is

due to lack of understanding of what he is expected to do. The eye-balls have a tendency to twitching, or a slight jerky movement; possibly more marked in the right than the left eye. When following an object, especially toward the right side, lateral nystagmus is distinct. The pupils are somewhat dilated, but respond promptly to both light and accommodation. There is a fine tremor of the tongue; also a fine tremor of the hands, more marked in the right than in the left. Grasp good and equal. His walk suggests the "steppage gait;" this is exaggerated when walking with his eyes closed. During this test he always walks to the right. He has no Rombergism, but he stands with difficulty on either leg, with his eyes closed. The knee jerk on the right side is exaggerated, on the left side rather minus. No Babinski or ankle clonus. The reflexes in the upper extremity, wrist, biceps and scapulo-humeral, are exaggerated. Tactile and thermal sense normal, though he occasionally gives evidence of paræsthesia. No asteriognosis.

He left the hospital on January 7 to visit an uncle in the neighborhood, but returned to the hospital on the tenth and then went home. His peculiar gait mentioned in Dr. Bochrach's last examination was improved, and his general and mental condition also were improved.

After the second operation, his convulsions were as follows: December 23, 5 minutes; December 24, 5 minutes; December 28, 7 minutes. They were chiefly on the right side and the mouth was drawn to the right. December 30, two attacks, 6 and 3 minutes long respectively, similar in type to the one on the twenty-eighth. December 31, one attack, duration 5 minutes. There were no movements on this occasion on the right side, but only a clonic spasm of the left arm and leg, and the face was strongly drawn to the left.

October 26, 1906.—He was shown to the Society of Clinical Surgery in a clinic which I held at the Jefferson Medical College Hospital. His father states that he has had fewer attacks and that his intelligence is slowly improving. The ulcers on the top of his head are rather worse than when I last saw him two years before and cover the central half of space where there is no bone.

A new skiagraph taken at this time shows persistence of the gap seen in the first skiagraph, but the edges of the gap are, of course, rounded off and less sharply defined. The width of the

gap in the bone is the same as immediately after the operation. Dr. Haines writes me, January 25, 1907, that the top of the skull does not seem to him to be movable.

REMARKS.

That the baby did not die from the accident is extraordinary, but it is not a cause of astonishment that he should develop an abnormal shape of his head or an abnormal mental condition accompanied with epilepsy.

That popular myth, "pressure on the brain," is certainly realized in this case, as shown by the deep furrow on top of his head and by the measured contraction of the original defect in the skull. His head, though of very abnormal shape, is of the average size for a boy of fourteen. Hence the head has enlarged very much since the bones exfoliated thirteen years before. But instead of the opening left by this exfoliation enlarging *pari passu* with the growing head, it has greatly contracted. Adjusting the necrosed bones accurately together and exclusive of the lost piece, the aperture left by their exfoliation must have been 17 by 11 cm. At fourteen years of age this opening had contracted to 8 by 5 cm. Not only had contraction taken place in the horizontal plane, but the deep furrow on top of the head shows that a marked contraction had taken place in the vertical plane.

That the epilepsy and mental dulness have been caused by the contraction and consequent pressure, and by the physical alteration in the structure of the cortex itself by the burn, I think there can be no doubt. The only wonder is that he is not wholly idiotic as well as epileptic.

While I had little hope of benefitting the boy by any operation, it seemed to me he ought at least to have the possible chance of benefit from the relief of pressure, provided such an operation would not be almost certainly fatal. As described in the notes, my idea was to make the entire calvaria movable so that it could be lifted like a lid on top of the head. If, then, the brain had any power of expansion it might lift the calvaria and so get more room.

The apparent immediate result seemed to promise considerable improvement, but after two years I fear that this will be slow in its progress and will not be as great as could be desired. Yet the lessened frequency of his epileptic attacks is a positive improvement and he is certainly somewhat less dull than he was when I first saw him.

THE SURGICAL TREATMENT OF TRIFACIAL NEURALGIA.

WITH REPORT OF EIGHT CASES OF RESECTION OF THE GASSERIAN GANGLION.

BY FRANK MARTIN, M.D.,

OF BALTIMORE, MD.,

Clinical Professor of Surgery in the University of Maryland.

ON September 12, 1892, I had the pleasure of assisting Dr. L. McLane Tiffany in doing a Gasserian ganglion operation according to the Hartley-Krause method, here in the city of Baltimore. It so happened that it was the first one that had ever been performed here, and followed soon after the introduction of the Hartley-Krause method. That patient, I may say, did perfectly well and is still living to-day, and has had no recurrence of pain whatever since operation. In her case she had been operated upon a number of times, having had done all the peripheral operations with a temporary relief following each one, and then recurrence of all the trouble.

Dr. Tiffany was not only the pioneer, I might say, in this city, but did a vast deal for the progress and advancement of this work, and his results were better than any operator at that time. He also published a most excellent and exhaustive article entitled, "Intracranial Operations for the Cure of Facial Neuralgia," giving his experience with a large number of cases and also collected and tabulated all the work that was done in this line up to the time of publication of his article. This article was published in the "Transactions of the American Surgical Association," volume xiv, 1896, and in *ANNALS OF SURGERY*, November and December, 1896. In this article Dr. Tiffany goes over the entire subject most thoroughly, having collected in all 108 cases, and gives a brief history of each one. Of these cases nearly two-thirds were subjected to the Hartley-Krause operation, nearly one-fourth to that of Rose, 7 to that of Horsley, 4 by the method of Doyen, Quenu 4, and Novaro 1, while 1 is uncertain since no method is mentioned. There

were 47 operators, 25 of them operating once each. The outcome of his research in this line shows that out of 108 cases there were 24 deaths, a mortality percentage of 22. The principal causes of death were put down as shock and sepsis. This report includes 10 cases operated upon by Dr. Tiffany himself; this shows his mortality to be less, namely, 2 deaths in 10 cases. Dr. Keen's cases in this tabulated article show 2 deaths in 10 cases likewise. It will also be noted in looking over the ages recorded in these various tabulated cases that the vast majority of the cases were markedly advanced in life, feeble, and had been worn out by long-continued suffering, and it is surprising to note how well they stand the surgical shock of this formidable procedure. In my series of cases, likewise, the age limit has been well advanced; the cases have universally been aged people.

I had the privilege of assisting Dr. Tiffany in most of his own personal cases and am in a position to speak accurately of the great skill with which he performed and accomplished these operations. The mortality following his work was low, as shown above, and the results so far as relief of pain were absolutely perfect, and he should be given great credit for having perfected the operation in a marked degree. He by no means adhered strictly to the Hartley-Krause method, but departed from their method in many points where the change was for the bettering of the method of approach and a proper access to the ganglion. For instance, he soon gave up the osteoplastic flap and took away sufficient amount of bone in order to enable him to have good access to the middle fossa. It was only in the very earliest cases he attempted to put back the bone flap, and I might here state that in none of his cases, so far as I remember, were there any permanent serious complications following the operation. There were some temporary eye disturbances, which all cleared up in a short while, save for one case (Case CVI in his series), where a second operation was done; the patient at the time of operation having a well marked and bad corneal ulcer. In this case the patient recovered and pain was abolished, but eye was lost.

It has been my experience to do all the peripheral operations where the trouble has been limited to one or more nerves, with the usual results of temporary relief; most of those cases, however, have come later on for the ganglion operation. In some few of the ganglion operations that I have done, in fact most of them, the peripheral operations have been done by some other surgeon with the usual results, namely, recurrence of pain, before they came for the more serious ganglion operation. I have in several of my cases, however, done the ganglion operation primarily without resorting to the division of the nerves; in those cases it has seemed clear to me that nothing short of a ganglion operation would give them relief.

In my first cases I made use of the Hartley-Krause method; since then I have used a lower route, dividing the zygoma and discarding the osteoplastic flap, going lower in temporal fossa and biting away the bone in order to make my opening sufficiently large. This is a method very similar to Cushing's method. I have never yet strictly confined my opening in the skull to the arch under the middle meningeal artery, but often get into the artery, and if so, tie it in the dura. The dura is then stripped up from the middle fossa down to the second division of the fifth; then the third division is sought for; the dura is then split between these two roots and the top layer of the ganglionic sheath is raised and the ganglion uncovered.

The recent results following removal of the ganglion in toto have been, as I said before, most satisfactory and most permanent in the cases that have been watched for any length of time. Whether the recurrence of pain will follow, that is a subject difficult to know, due to the short period since many of the operations have been done. It seems to be pretty definitely settled that total removal of the ganglion as distinct from a partial operation, is attended by permanent cessation of pain. It is certain, so far as the physiologic knowledge of the process of nerve repair goes, that there can be no peripheral regeneration of the system of sensory neurons after a thorough removal of the ganglion, so that those that come out successfully from a well conducted operation are relieved of their pain at least, even

if they do have possible eye complications. There have been some temporary eye symptoms in almost all of my cases. In my last one the sixth nerve was interfered with for quite a while, and the man had paralysis of the external rectus and certain amount of diplopia, which cleared up entirely after several months. The great drawback to the advancement of the operation has been the high mortality attending it. I think the keynote of the successful accomplishment of the operation is the avoidance of hæmorrhage, and if this can be accomplished the operation is generally not attended by any great degree of shock. I am convinced it has been the cause of the majority of deaths. Sepsis and brain infection should be avoided. Hæmorrhage explains, doubtless, the high mortality variously estimated at 20 per cent. This is needlessly high, however, and should not be; and I am convinced that if the statistics of the operators who are doing most work in this line were looked into the percentage mortality would be found much lower. In a recent monograph by J. Hutchinson, Jr., on "The Surgical Treatment of Trifacial Neuralgia," he goes over the subject very thoroughly and calls attention to the work of Sir Victor Horsley, whom, he states, has performed 120 operations with but 6 deaths; so, likewise, with the work of other operators, I think the statistics will show the mortality to be very much less.

The avoidance of hæmorrhage is at times an exceptionally difficult thing in my experience. I think I voice the sentiments of almost every surgeon when I say it is the principal thing we fear, and I venture to say that it has been the experience of almost every surgeon to meet with serious hæmorrhage in one or more of his cases. I am convinced that in one of my cases the death was unquestionably due to the amount of blood lost during operation. In those cases where I have not had hæmorrhage to annoy me the patients have made uninterrupted recoveries; their pain being immediately relieved and their progress most satisfactory, in fact, have been up in the course of 36 to 48 hours. After this their recovery is speedy, and as a rule they are out of the hospital at the end of a week, with

wound entirely healed. It is astonishing to see how rapidly these patients convalesce; as was mentioned above, most of them are well advanced in age and their resisting powers generally have been weakened by long-continued pain, and it is perfectly surprising, that when they do do well, how rapid their recovery is and how little their general health is interfered with during convalescence.

The operation is one in my judgment absolutely not an operation to be demonstrated to a class. It is an operation that requires all the dexterity that a skillful operator can possess, and it is one that he is unjustified in attempting to let those who are looking on attempt to see; by doing this he not only wastes time but is apt in his demonstration to do damage and get into a hæmorrhage which may cost the life of his patient. I believe that the proper procedure is to do it slowly, carefully, and to center one's entire attention on it and not attempt to stop and let others see. The first assistant is the only one that can see anything. It is done through a small opening and the work is to be done between intervals of hæmorrhage which well up from deep down in middle fossa. Pressure will usually stop without difficulty these hæmorrhages that well up, and after they have been stopped by pressure maintained for a short while, then one proceeds on in endeavoring to enucleate and free the ganglion from its bed. By working carefully around the third division and slowly progressing backwards towards the pons one can in this way get at the back of the ganglion, or sensory root, without encroaching upon and endangering the patient's life by opening into the cavernous sinus. If the ganglion can be worked free from its bed in this way it can be sectioned across behind the ganglion without undue hæmorrhage. The sectioning across of the sensory root back of the ganglion is the most essential step in getting a complete subsidence of the pain. When this is done successfully it cuts off completely all the sensory distributions conducted through the various branches of the fifth nerve, and it is a matter of no special moment whether the ganglion is left in or whether it is removed; the division back of the ganglion is the most im-

portant thing, and pulling forward the divided distal end is all that is necessary, so that it cannot reunite with the proximal end; by pulling it forward so that regeneration cannot become established is all that is necessary, and the actual pulling out of the ganglion, which may be attended by serious hæmorrhage, can be avoided. When the attempt is made to get it raised out of its bed before it is well worked up from behind, one always has difficulty with serious hæmorrhage and one is liable to tear into the cavernous sinus. The top layer of the ganglionic sheath should be separated from the ganglion first, until it is well uncovered, and no attempt should be made to separate the ganglion from its under ganglionic sheath until all the other work has been completed. It is an operation that is so trying on the operator—so tedious and so long drawn out—that a day should be set apart for it, with nothing else attempted on that day—certainly no operation before a Gasserian ganglion is done. I do not know how it is with other operators, but it takes me a number of hours to complete one satisfactorily.

I wish to append a brief report of the eight cases. The first two cases were done by the Hartley-Krause method with the osteoplastic flap, but in neither of them was bone replaced. Others were done by lower incision, followed by division of the zygoma and the skull opening made low down in temporal fossa, first with the chisel and then with rongeur forceps. In my recent cases the anterior arm of the incision has been so planned as not to divide the nerve going into the occipitofrontalis, which when divided, causes drooping of the eyelid and disappearance of wrinkle of brow on that side. In this list of cases it will be noted there have been two deaths; one from ether pneumonia, and the other from shock, unquestionably brought about by hæmorrhage at time of operation.

CASE I.—Female, white, aged seventy; operation November 30, 1899.

Previous History.—Had suffered with trifacial neuralgia for five or six years. No peripheral operation had been done previously. It had apparently invaded all the branches. Operation. Hartley-Krause. The ganglion was removed. Immediate result.

FIG. 1.



Gasserian glanglion removed December 28, 1899. No. 1, Sensory and motor root. No. 2, Third division (inferior maxillary). No. 3, Second division (superior maxillary). No. 4, Where it was torn loose from first division. The specimen has been so turned over that it does not show it in the proper position.

FIG. 2.



Mrs. M. E., white, aged 75, operated upon Dec. 28, 1899, for facial neuralgia. Entire Gasserian ganglion removed. Picture taken ten days after operation. Right side of face inside of pencil marking shows area of complete anæsthesia to touch, pain and temperature changes.

Abolishment of pain; patient made uneventful recovery; healed under one dressing. Ultimate result. No recurrence of pain.

CASE II.—*Removal of the entire Gasserian ganglion and its sensory and motor roots back nearly to the pons, as a primary operation for the relief of facial neuralgia, involving the three divisions.* Female, white, German, aged seventy-five; operation December 28, 1899.

Previous History.—She was a typical sufferer with trigeminal neuralgia for five years, involving all three divisions of right fifth. Attacks were less frequent at first but very severe from their incipency, increasing in frequency and severity until the last six months when they have become almost constant.

Previous Treatment.—Medical treatment of all kinds had been resorted to; morphia in large doses would not alleviate; no operative interference of any kind had been done. On account of involvement of all three divisions, primary removal of the Gasserian ganglion was done.

Operation.—Hartley-Krause. Osteoplastic flap, which bone flap was not put back. When the skull was opened and the osteoplastic flap turned down the second division of the fifth at the foramen rotundum came into view first, after the brain was lifted from middle fossa; the third division at the foramen ovale was next seen and the ganglion soon uncovered. The two divisions, third and second, were cut across and the ganglion picked up by a pair of artery forceps and evulsed from its bed and a long piece of the sensory root came away with it (as shown in Fig 1). There was an excessive flow of blood and I feared I had torn into the cavernous sinus. Pressure was made by gauze pledgets; when these were removed blood still welled up, so I presume the cavernous sinus was torn into. I packed this cavity with two pieces of tampon sterile gauze, bringing them out at the lower angle of wound. The flap was replaced and wound closed with subcuticular silver-wire sutures. To prevent foreign body getting on anæsthetic cornea, I closed the eye by suturing the lids together. Immediate result: Patient reacted nicely and expressed herself as entirely free from pain, the relief of which was complete and permanent. The sutures were removed on the fifth day and the lids were opened; no irritation whatever about the cornea. A Butler's shield was placed over the eye and worn. At the end of ten days all dressings were removed

and wound entirely healed, as will be seen by accompanying photograph; the patient was entirely free from all pain. The markings on photograph indicate area of anæsthesia * (Fig. 2).

Examination of patient four weeks after operation is as follows: Muscles supplied by left branches of facial show normal innervation. When patient compresses teeth forcibly the right masseter muscle does not stand out as prominently as the left, since it is less forcibly contracted, one can readily palpate this difference in the hardness of the muscles on both sides when thus contracted. Pharyngeal reflex normal on both sides. No evidence of any vasomotor irritability about the face, the color being in general rather pale. Sense of taste dulled on anterior two-thirds of right half, patient being unable to distinguish sour or sweet substances, but distinguishes very bitter (quinine and, strange to say, salt). Slight dulling to temperature and pain on right side of tongue. Both eyes are moist; no particles of dust in right cornea, which is perfectly clear. Pupils equal and react well to light and accommodation. Tongue in median line. No paralysis of any facial muscles except right half of frontalis, which is almost completely paralyzed, not the orbicularis, however. This paralysis may be due to cutting the nerve supply of the muscles in large flap operation. Ultimate result: Recovery and permanent cessation of pain.

CASE III.—Male, white, aged seventy-six; operation March 14, 1901.

Previous History.—He had had facial neuralgia for a number of years.

Previous Treatment.—Two or three years prior to my operating upon him he had had a peripheral operation done for the removal of the third division through angle of jaw by Dr. Tiffany. This gave him temporary relief, but it returned with all its vigor, attacking other branches of the fifth. He was suffering excruciating agony, with the pain ranging through all three divisions.

Operation.—Hartley-Krause. I got the ganglion beautifully uncovered and removed it as neatly and nicely as any

* This is among my earlier cases and the scar is very pronounced; in my later cases the opening has been much smaller and the depression is not nearly so marked.

case I ever did, and had practically no trouble whatever. He reacted nicely, but unfortunately, as it was a ward case I did it in the amphitheatre before a large class of students; it was a bitterly cold day and considerable time was taken up in endeavoring to demonstrate to the students the ganglion in its bed; this naturally prolonged the operation and prolonged the effects of ether. Immediate result: His wound did perfectly well and was practically all healed, but the day following operation he developed ether pneumonia which ran a fatal course, and on morning of fifth day following operation resulted in death. This death should not be attributed to the ganglion operation, because the case was done perfectly quietly with no disturbance whatever, no hæmorrhage of any consequence, and no shock; it was purely a case of ether pneumonia, and really should not be attributed to the removal of the ganglion, because it would probably have occurred from any operation.

CASE IV.—Female, white, aged fifty-one; operation November 7, 1903.

Previous History.—Began with attacks of neuralgia in lower teeth.

Previous Treatment.—Her teeth had all been removed at various intervals without alleviation. In 1891 Dr. Tiffany divided the inferior dental branch in the foramen at the angle of the jaw; this gave her relief for seven months, when a pain recurred not only in the inferior dental branch but in the inferior maxillary, and was more intense in second division, so a second peripheral operation was done by Dr. Tiffany; the superior maxillary was removed by incision just under orbit; large section of nerve was removed by twisting and contortion. She returned to the hospital November 5, 1903, complaining of neuralgia in violent form; the last peripheral operation gave her relief for five months. She came in this time complaining of pain distributed over entire region of fifth. On entrance she stated she had been suffering constantly, getting worse and worse each day, since July 1, 1903. (I failed to note that the supra-orbital nerve was also cut previously.)

Operation.—Right Gasserian ganglion was removed November 7, 1903. The method of approach was a little different from the Hartley-Krause method; flap was made lower and opening

in skull was made lower and enlarged sufficiently to enable me to have access; zygoma was divided and skull entered much lower. A horse-shoe incision, having for its base the zygoma, about $1\frac{1}{4}$ inches wide at this point and about two inches high, was made, cutting through the skin, muscle and fascia. The zygoma was then exposed and cut at each extremity, and flap of skin and muscle and fascia retracted with the zygoma. The periosteum being peeled back, a small area about one-half inch in diameter was then chiselled out and the opening enlarged with rongeur forceps to about one inch in diameter; this exposed the dura with the middle meningeal, which was ligated with two silk sutures and cut between. The dura and brain were then lifted gently from middle fossa and second and third divisions came into view, and by dissecting between these two the ganglion was soon uncovered and removed without difficulty. Certain amount of bleeding occurred when ganglion was gotten away, which necessitated a bit of gauze being left in for pressure and brought out at lower angle of wound. The soft parts were replaced and flaps stitched around with interrupted stitches of fine silk; at the first dressing intervening stitches were removed and in that way left practically no scar. Immediate result: Patient was somewhat shocked but soon rallied and made an uninterrupted recovery; the gauze packing was removed at end of thirty-six hours and wound allowed to close; at the end of a week she was up and about with wound entirely healed. The eye symptoms following operation were temporary, consisting of dilated pupil, some fixity of eye, and ptosis; this all cleared up in a few days and then disappeared entirely. Ultimate result: Recovery; no recurrence of pain. The highest temperature in this case was 100; it reached normal on second day after operation and ran normal balance of stay in hospital. She was dismissed from hospital as cured on tenth day.

CASE V.—Female, white, aged fifty-seven; operation December 2, 1903.

History of Disease.—Has had persistent neuralgia for twelve years. Twelve years ago the trouble began with creepy sensations along the right cheek which became very annoying, but to which she gave no significance after probably four months. Then she was suddenly taken with this intense neuralgia which lasted

a few minutes and then passed off; this history went on, trouble growing worse each month, disappearing and recurring at intervals.

Previous Treatment.—In 1901 Dr. Tiffany did a peripheral operation, resecting the supra- and infra-orbital nerves on right side, which afforded relief until February, 1902 (nine months). At this time the attacks began again, of the same character but with more intensity and more frequency, persisting through several days and then disappearing for a month or more. This history of recurring pain continued until she entered the hospital November 29, 1903. She then complained of paroxysmal attacks of the most excruciating character, continuing for about one minute and recurring at intervals of about five minutes. The pain comes on as a sharp penetrating pain; to use the patient's own words, "Like a red hot vice twisting the nerves," radiating over the eye, under the eye, along the cheek back to the ear and along roof of mouth on right side. When in a paroxysm patient seems to suffer most intensely, cries quietly and presents a most pitiful picture, with tears running from the eye and water dropping from the nose. Physical examination: She is a large, well-built, well-preserved woman, in good physical condition.

Operation.—The method of approach was a little different from the Hartley-Krause method; flap and opening in skull were made lower; zygoma was divided and skull entered much lower. A horse-shoe incision, having for its base the zygoma, about $1\frac{1}{4}$ inches wide at this point and about 2 inches high, was made, cutting through skin, muscle and fascia. Periosteum was peeled back, chisel being used for opening skull, which opening was enlarged by rongeur forceps, brain was lifted from middle fossa, the second and third divisions were clearly seen and the capsule of dura covering ganglion was stripped from off top of ganglion and second and third divisions were cut and ganglion removed. There was considerable hæmorrhage in attempting to uncover and isolate ganglion. The wound was closed in my usual way, using interrupted silk sutures and dressings applied. Immediate result: Patient was very little shocked; pain abolished immediately upon awakening from anæsthetic; wound healed and no reaction followed operation. She was sitting up on third day and left the hospital on tenth day; no unfavorable eye symp-

toms in this case at all; motion unimpaired. She wore a Butler's shield to protect the eye from foreign bodies and cornea was anæsthetic. Ultimate result: Recovery, and has had no recurrence of pain.

CASE VI.—Female, white, aged seventy-eight; operation March 20, 1906.

History of Disease.—She has had neuralgia involving two lower branches of right fifth for the last fifteen years; the beginning of it was apparently in her third division, and four or five weeks after it began in the third division it started in the second division; there has never been any pain referable to the first or ophthalmic division. Has never had any previous operation.

Operation.—The second and third divisions were removed and with them part of the ganglion, which came away by torsion. Immediate result: Cessation of pain and uninterrupted recovery. Ultimate result: So far there has been no recurrence.

CASE VII.—Male, white, aged fifty-seven; operation March 27, 1906.

History of Disease.—He has suffered with trifacial neuralgia for the last twelve years, having intervals of quiescence; during last several months has had to stay away from business on account of the severity of the attacks which are now almost constant. The first and second division of the fifth seem to be at fault. I advised a Gasserian ganglion operation and sent him to the University of Maryland Hospital.

Operation.—Under ether I made a horse-shoe incision in the right temporal region extending up from the zygomatic arch about 5 cm.; the base of the incision was about 4 cm., which corresponded to the zygomatic arch. The skin flap was dissected down to base line of this flap and the temporal fascia was opened, incision running in similar way to the skin incision, but the size of this flap was smaller from one-half to three-fourths of an inch; this was turned back likewise. I uncovered the zygomatic arch, stripped back periosteum from it, and with strong biting forceps cut it across; the periosteum was likewise separated from it back near to temporal bone and there cut across in order that the zygomatic arch could be pulled down with the soft parts, thereby enlarging the space. A similar horse-shoe flap was then

made through the temporal muscle, still smaller in size than the fascia; this went down to the periosteum of the skull and it was pulled down with the zygomatic arch, and the skull uncovered deep down in the temporal fossa; a small trephine was then inserted and a small groove started in the bone; I abandoned the trephine and took a chisel and opened the head at this point; as soon as the bone was raised, or skull entered, there was bleeding from a branch of the middle meningeal artery; by making compression over this I was able to stop bleeding, and then enlarged opening by rongeur forceps to size of half-dollar, biting downwards, so as to get down to base of fossa as far as possible. First the rongeur forceps bit away a portion of the temporal bone and then a greater wing of the sphenoid; there was very little bleeding during these steps of the operation to get into the skull; the bleeding points were arrested, most of them tied off. Then with a brain elevator I stripped up the middle lobe, with its dura attached, from the middle fossa and soon came down upon the foramen ovale, through which passed the third division of the fifth; after getting that located I separated the dura attachment between the third and second divisions with a knife, and with my Gasserian ganglion spoon, the dura which made the top layer of the ganglion was stripped back, uncovering the ganglion on top; during this there was some little bleeding, but not much. In elevating the dura I elevated the arch of the middle meningeal artery, so that it could be clearly seen coming out of the foramen spinosum. I failed to note, however, that when the foramen ovale came into view, there was a marked prominence of bone known as the crista infra-temporalis, or ridge of bone projecting up in the fossa, interfering very markedly with the structures in the region of the ganglion; this I had to chisel and bite away with the rongeur forceps before I could proceed with the extraction of the ganglion. By proceeding slowly and stripping up the upper layer of dura I was able to liberate the ganglion, definitely and clearly showing its three branches going off. I proceeded slowly behind and was able to isolate the sensory root proximal to the ganglion; this root was gotten up and held by forceps; a loop was passed around the second and third divisions and silk ligature passed around; they were pulled up and cut across with scissors close to the foramen; then with the forceps attached to the sensory root, I tried to evulse the ganglion with

the sensory root from its bed; this root was torn across and a small bit of the ganglion came away with the forceps, but in doing this I must have torn into the sinus, because there was a great deal of bleeding which was more or less easily controlled by packing with gauze, but it did not stop sufficiently for me to continue in enucleating the balance of the ganglion; every time the gauze was taken out the bleeding would go on to such an extent I could not see what to do. This continued for quite a while, and as the patient had been under the anæsthetic for a long time, and the bleeding did not seem to be stopping, and in view of the fact that I had torn across the sensory root proximal to the ganglion and had cut across the second and third divisions of the fifth and had enucleated the ganglion from its bed thoroughly, I decided I had better abandon the attempt to get the rest of it away for fear he would not recover; so I packed a small bit of gauze at the site of the bleeding and closed the wound by layers; first, the temporal muscle was brought up and stitched to its cut fibers; then the fascia was brought up and stitched, and the skin flap likewise brought back into position and fastened by interrupted sutures of fine silk. The whole wound was closed except for this small drainage which came out at the lower and posterior angle of the wound next the ear. Immediate result: He reacted from operation fairly well and was in pretty good shape.

March 30, 1906.—He had immediate quiescence of pain through the distribution of the fifth following operation, and had complete anæsthesia all over the region of the fifth distribution; he had some reaction the first twenty-four hours and some slight elevation of temperature and complained of great pain in his back, in lumbar region, and in back of his neck; this I attributed to the long position on the operating table, because he was on there at least four hours; he went on the table with a certain amount of lumbago and I think it was made worse. The dressings were changed on March 29, forty-eight hours after operation, and the gauze packing was removed entirely. There had been considerable oozing, so I put back a very small piece of gauze only a short distance in the drain track. On the thirtieth I dressed him again, took this out, and there was considerable cerebrospinal fluid which came out following it, and with each pulsation of the brain there was a drop of this cerebrospinal fluid which oozed out; a

small wick of gauze was put back again on account of this fluid draining. A number of the sutures were removed here and there; wound is healing primarily and all is going well; has had no discomfort whatever in face, some pain in back, but none in back of neck.

April 2, 1906.—On April first I removed all further sutures from his head and left out all gauze packing; his wound healed primarily; pain has entirely abated; his eye shows signs of paralysis of the external rectus muscle, showing that there is either temporary or permanent paralysis of the sixth nerve, because it does not work. The conjunctiva of the eye is clear, but right over the pupil there seems to be a little speck which at first looked like a foreign body, but I am fearful that it may mean the beginning of conjunctival necrosis, which is the forerunner of conical ulcer. The eye was washed out with borax solution; there is absolutely no sensation in the conjunctiva. Ultimate result: Recovery. Eye symptoms all cleared up, and he has had no recurrence of pain whatever.

CASE VIII.—Female, white, aged thirty-six; operation August 9, 1906.

History of Disease.—Has had pain in right side of face since last September. The pain involved practically all divisions of the fifth.

Previous Treatment.—Has had all her teeth extracted without obtaining relief. Entered University of Maryland August 4, 1906.

Operation.—Under ether I opened down by making a horse-shoe flap in right temporal region; dissected skin back a certain distance and then cut temporal fascia around, less large than skin flap, divided zygoma, sectioned it across and cut temporal muscle down to bone. The temporal muscle was pulled down with temporal fascia and section of zygoma and skull uncovered down near base. Then with a chisel I made a small opening in skull as far down as I could get and bit away sufficient opening to enable me to get inside middle fossa. Then with brain retractor I pushed brain and elevated it away from middle fossa and worked my way down to second division of fifth nerve as it goes up to foramen; after getting that well exposed I divided between it and third division the envelope of dura which holds in place the

ganglion; I then stripped the upper end of dura back and uncovered the ganglion. I had considerable bleeding, but finally got it so I could see the ganglion clearly and showed it to a number of lookers-on. I then passed with a long needle a string around second division and began to enucleate the ganglion from its bed; there was considerable bleeding. I then got around third division of fifth, got it up and cut it across. I put a clamp on ganglion side and cut second division across; then with a clamp on ganglion I endeavored to get it up out of its bed; the clamp pulled off, bringing away only a small bit of ganglion; this was followed by considerable oozing; endeavoring to get this oozing stopped I pushed ganglion well up out of its bed, up above middle line of base; by using gauze pledgets to stop the oozing I finally got this sufficiently stopped to seek for rest of ganglion and endeavor to remove it. After getting field clear I put down a pair of hysterectomy forceps and tried to grasp remains of ganglion; I thought I had clamped it and made a pull on it, and when I did so, a tremendous whirlpool of blood gushed out, so I presume I tore the sinus; the clamp came away and I packed as quickly as possible large pledgets of gauze down in middle fossa to arrest hæmorrhage, which was more profuse than any I have ever seen in a ganglion operation. I finally got it controlled by pressure, and after holding it for a little while I thought I would remove this packing and see if hæmorrhage had been controlled; in attempting to remove it the same whirlpool of blood came out, not venous bleeding but arterial hæmorrhage. I packed it as quickly as possible, but it welled out all around and told very markedly on patient. This seemed to control it and I made a third attempt to remove this tight packing to see if I could not get on with less packing and see if pressure had controlled it. The same thing occurred on third trial; the gushing of blood was equally terrific and told on patient; her pulse went up and she showed evidence of hæmorrhage, so I packed it as speedily as possible and left in a large piece of gauze which practically filled middle fossa, and by making firm pressure on it the hæmorrhage was stopped. Then I brought temporal fascia lightly together with fine silk and brought the skin flap up in place and stitched it around, leaving gauze coming out of the wound just in front of the ear. I put on dressings, bandaging them tightly so as to make pressure continuous to control further bleeding. When

she went off the table her pulse was quite weak, feeble and rapid. When I left the hospital her pulse had toned down and pupil dilatation had contracted considerably; there was an enormous dilatation in right eye, which showed evidence of pressure against motor oculi. Result: Patient died from shock the morning following operation.

REPORT OF A CASE OF HÆMOPHILIC KNEE JOINT. OPERATION; RECOVERY UNDER THE USE OF THYROID EXTRACT.*

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N. G., a waiter, twenty-two years of age, was referred to me for trouble in his knee, by Dr. Geo. C. Clarke of this city. The family history is negative so far as bleeding is concerned. His mother died when he was an infant; his father and one brother are living and well.

His personal history is that at five years of age he had suppurating inguinal glands, but had none of the diseases of childhood. Cuts or injuries occasioned no greater hæmorrhage than occurs in the ordinary individual. He had during boyhood an attack of nose-bleed continuing daily for several weeks, but without any deleterious effects. Prior to my seeing him, he had two hæmorrhages following biting of the tongue, each of which lasted for about three weeks and left him much exhausted by the loss of blood. The last one of these occurred within the past two years and he was cared for by Drs. Clarke and Page at the German Hospital.

When first seen, in March, 1906, he was extremely anæmic and sallow. He had not had good health for several years and constantly suffered from pain and soreness in his left knee. This trouble began when he was twelve years of age, at which time he fell, injuring the part slightly. Little attention was given it until the third day after the injury, when, following a long walk, the knee became greatly swollen and very painful. After two weeks' confinement in bed, the knee recovered entirely, but at irregular intervals of from one month to one year the joint has been swollen and painful just as after the first injury. Any overuse of the part sufficed to relight the trouble until finally

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tenderness became constant in spots and more especially on the inner side of the patella. Marked enlargement finally occurred and function became impaired. Flexion beyond 60 degrees was impossible but extension was normal and walking was not painful. A slight fall or forced flexion would cause an outbreak of pain and swelling severe enough to put him in bed for two or three weeks. As no history of bleeding was obtained at this time, the condition was considered a chronic synovitis of probable tubercular origin with thickening of the synovial fringes. Local applications of ung. ichthyol and similar remedies were used without benefit. Plaster of Paris was applied for six weeks and the use of the part much restricted, but without appreciable results. An X-ray plate made shortly after coming under observation showed thickening of the soft structures but no apparent alteration of the bony. The condition finally became so troublesome that he was unable to continue his vocation, and operation was advised for the removal of a supposed hypertrophy of the ligamenta alaria just below the patella. He had been taking the Syrupus Ferri Iodidi for several months with some improvement in appearance and general health. He entered the Methodist Hospital on July 17, 1906, and was prepared for operation which was done on the following day. Attention was directed to the attacks of lingual hæmorrhage, but on account of the absence of bleeding in any other portions of the body following cuts, etc., these were considered as due more to the condition of anæmia and the vascularity of the tongue.

The joint was opened by a straight incision on the inner side of the patella. The appearance of the tissues of the joint was striking and totally unlike any I had ever seen. The synovial fringes were found thickened and the ligamenta alaria below the patella were very much hypertrophied. The entire synovium was of a dirty brown or chocolate color. There was no evidence of recent hæmorrhage, but the fringes appeared as if about to undergo sloughing, a condition which is described as characteristic of the hæmophilic joint. The hypertrophied portions were thoroughly excised both on the lateral and on the infrapatellar surfaces. There was but an ordinary amount of bleeding at the time both in the skin incision and within the joint and no ligatures were used though two small vessels were cut in making the opening incision. Six strands of silk-worm gut were used for

drainage of the joint and the incision was closed with the same material for sutures. One of the small vessels cut showed a tendency to bleed and was caught with a suture and easily controlled. The leg was placed upon a posterior straight splint and an ice-cap ordered applied continuously.

July 19.—Wound dressed to-day. Considerable oozing but not more than is frequently seen after similar operation. The drainage was removed and there immediately occurred a gush of blood which continued to flow. The lower suture (which had caught a bleeding vessel) was removed and the vessel began to spurt blood. A pressure bandage was applied and an ice-cap kept on constantly. A few hours later, it was found that bleeding was still present and it was necessary to introduce two stitches to control it. Morph. sulph., $\frac{1}{6}$ gr., and atroph. sulph., $\frac{1}{150}$ gr., were administered hypodermatically several times during the day to control pain and hæmorrhage.

July 20.—Patient had a bad night. Was very restless and complained much of pain in the knee, describing it as a *pressure*. The knee was greatly distended and very painful. It was surrounded by ice-bags and no bleeding was perceptible from without. He had one grain of codein during the night without benefit. Strych. sulph., $\frac{1}{30}$ gr., was given every three hours and iron in the form of Basham's mixture was begun. He also received a high enema of whiskey 1 ounce, ammon. carb., 20 grs., and normal salt solution 6 ounces, because of the exhaustion and weakness. Gradual improvement followed and the leg was not dressed until the twenty-fourth. Calcium chloride, 15 grs., every three hours was begun on the twenty-third and continued for three days and on this date his temperature rose to above 101 degrees.

When the dressings were removed on the twenty-fourth, bleeding began immediately. A probe was gently inserted into the lower end of the incision and the hæmorrhage became profuse. Pressure with the bandage controlled it completely and the ice-bags were continued. On the twenty-sixth the stitches were cut but not removed, and even this caused bleeding which could not be controlled by pressure and it became necessary to introduce two sutures. There was severe and constant pain in the knee and extending to the foot. Sleep was impossible without codein or morphin.

On the twenty-seventh, he was given by mouth 6 ounces of a 10 per cent. solution of gelatin twice daily and on the twenty-eighth the leg and foot were encased in an interrupted plaster splint. Adrenalin solution (1-1000) in 8 minim doses was given every four hours but with no effect upon the hæmorrhage. The influence of the plaster splint was noticeable in the temperature which fell gradually during the following week. The effects of the gelatin upon the clotting of the blood were most marked, the resultant clot forming very rapidly and proving the most firm and elastic that I have ever seen. The escaping blood formed in a clot under the dressings and this could be lifted from its position with ease and handled very freely without breaking. It had much the consistence of gelatin but was slightly more elastic. The gelatin and adrenalin were continued until August 5, and constant oozing was present. The lips of the wound had separated and exposed an unhealthy granulating and bleeding surface. The entire knee was much swollen and the patient's condition was far from encouraging. On this date, thyroid extract in 5 gr. doses three times daily was begun. Immediate benefit resulted, the temperature dropping still further and the bleeding lessening. By the eighth, bleeding had entirely ceased, though there remained serous oozing from the necrotic area of the wound. Pain lessened and the patient began to eat. A blood count made on the eleventh, showed red cells, 4,310,000, white cells 6,720, hæmoglobin 60 per cent. The records of examinations made previously have been lost, but my personal recollection is that the hæmoglobin was as low as 30 per cent a week after the operation.

From this time on the progress was rather rapid and in two weeks the wound had entirely healed and he was walking about on crutches. Strength quickly returned, color became better and he continued to take the thyroid and that alone. On August 27, while eating dinner, he accidentally bit his tongue and free oozing of blood began. Monsel's solution was immediately applied and the bleeding ceased. Repeated hæmorrhages occurred during the ensuing week, but were temporarily checked with Monsel's solution. Aside from this, the patient looked and felt well and had no pain or trouble in the knee. He left the hospital on September 8, seemingly in perfect health. The cast was removed from the knee a few weeks later and he was warned against using

the leg in walking. A small clot or magma was still adherent to the tongue from the action of the Monsel solution, but there was absolutely no bleeding. A short stay at the seashore proved extremely beneficial and he is now following his work as a waiter with perfect comfort to himself. He has not yet regained full use of the joint, though movements to increase flexion have been advised. He is extremely cautious of motion of the part so as not to injure it in any way. Since he was twelve years of age, he has also had slight "rheumatic" pains in his right hip with trifling impairment of function, but as there is no actual disability or interference with his work, nothing has been done for it. The thyroid extract is still continued twice daily and the changed color and appearance furnish the best evidence of its beneficent effects. Two weeks ago, while descending a stairway, he slipped and wrenched the knee, but experienced absolutely no ill-effects from it, which is in marked contrast to the results of a similar injury prior to the time of operation.

An examination of the eye-grounds was made by Dr. C. A. Veasey to determine any possible evidence of change in the vessels of the fundus or the optic nerve. His report is as follows: "Vision, pupillary reactions, fundi, fields and external muscle rotations are normal. No abnormality whatever can be observed in the vessels of the fundi."

The two most widely accredited theories of the location of the cause of hæmophilia are (*a*) that it concerns the coagulability of the blood, and (*b*) that it lies in the tissues of the vessels. Many researches have been instituted to determine if possible which is correct, but failure has attended them thus far. Weil (*La Tribune Médicale*, Jan., 1907) believes that in hereditary hæmophilia there exist incoagulable substances in the blood which may have their origin in various organs, one of which is the liver (Delezenne). Sahli (*Zeitschrift f. klin. Med.*, 1904, vol. lvi, Nr. 3 and 4) believes the coagulation of the blood is at fault, but the cause of it lies in the vessel structures themselves, chiefly the endothelial lining. Weil (loc. cit.) publishes the effects of the use of normal serum when injected into a "bleeder." He says, "The treatment with injections of fresh serum, efficient though it may be, has no value in the

permanent cure of the affection. It does not attack the cause and is but an appropriate symptomatic medication. The dose . . . should be from ten to twenty cc. Human serum or the serum of a horse should be taken as they . . . do not give rise to accidents." This is an admission contrary to what he has endeavored to prove and points very strongly to the tissues as the parts at fault. The use of the thyroid extract also adds to this view, as it appears to supply some vital substance to the tissues which is lacking either totally or in part in these cases.

In the case just detailed, the marked change in the appearance of the wound, the healthy color of the granulations, etc., is in thorough accord with the observed action of the thyroid in other conditions. We are forced to admit, however, our ignorance of its mode of action, and until this is known all theories must remain as such, though it is thoroughly justifiable to venture the opinion that the blood is at fault in some instances and the tissues in others, while in still others both are affected.

STAB WOUNDS OF THE HEART.*

WITH REPORT OF A CASE.

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It has been the general impression on the part of the world at large that all wounds of the heart, no matter how trifling, so long as the pericardium was injured, the injury must be necessarily fatal. This was the accepted opinion of all of the older surgical writers. Hallerius appears to be the first to differ from this old accepted theory, and to assert that heart wounds were not necessarily fatal. It would seem as though these conclusions might have been arrived at long before, especially when hand-to-hand combat was so common, and, from the very nature of the arms employed, punctured wounds of the heart must have been very frequent. Many non-penetrating wounds of the heart must have recovered, and persons sustaining penetrating wounds must have often lived for some time, and were capable of making considerable exertion. To bear out this statement I recall a case which occurred when I was a resident at the Pennsylvania Hospital, in which a sailor was stabbed on board ship with a sailor's sheath knife (an ordinary butcher knife) which inflicted a penetrating wound from $1\frac{1}{4}$ to $1\frac{1}{2}$ inches in length in the left ventricle. The patient lived about two hours, but died shortly after his admission to the ward, apparently from the loss of blood and embarrassment of the heart's action due to a pericardium distended with blood clots.

Wolf, as long ago as 1642, gave the first reliable account of the healing of a heart wound. Later Desoult described the steps of an operation for the relief of pericardial empyema. In 1798 many cases were reported of heart wounds in which pro-

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tracted periods intervened between the receipt of the injury and death. Up to the end of the nineteenth century the treatment of heart wounds was purely expectant, consisting of rest, ice, cardiac sedatives, blisters, etc., etc.

In 1881 Dr. John B. Roberts suggested the propriety of attempting to suture the heart muscle in cases of stab-wounds. This idea, however, did not meet with much encouragement, as so distinguished a surgeon as Billroth declared that a surgeon who wished to retain the respect of his confrères would not attempt such a procedure.

Again, as the result of experimental research much light has been thrown upon the future of heart surgery, which may be voiced by the statements of Elsberg, quoted by Stewart in his classic paper on this subject.

The consensus of opinion among experimenters is, that the heart after being exposed can be grasped with the hands or forceps and gently compressed with no appreciable effect on its action; that punctures with needle or knife produce only a temporary irregularity in the heart's action; that wounds produced during systole bleed more than those occurring during diastole; that wounds of the ventricle produced during systole are larger than those produced during diastole; that oblique wounds bleed more than perpendicular wounds; that wounds of the right ventricle are more dangerous, because of the thin ventricular wall and because the blood in the right heart coagulates more slowly; that wounds of the heart heal kindly, and that the cicatrix is complete in two weeks; that interrupted sutures are better than continuous ones; that the material enclosed in the grasp of the sutures causes atrophy and is replaced by scar tissue; that superficial stitches are less liable to tear out than deeper ones, and that the stitches should be inserted and tied during diastole, because of the danger of tearing out during systole.

It will be seen that some of these opinions are of practical importance, while others are theoretical and impossible to carry into effect.

With this much learned as the result of experimental

research, two unsuccessful attempts were made in 1896 at cardiorrhaphy, and a year later Rehn published the report of the first successful operation. Since that time a number of successful cases have been reported, two by Fellows of this Academy, Dr. Stewart and Dr. Gibbon.

The heart may be wounded by all kinds of vulnerating bodies producing punctured, incised, lacerated and gunshot wounds, all of which may be received in a great variety of ways. In a large percentage of cases the pleura will be wounded. In a number of cases carefully analysed by Stewart, it was found that the pleura was wounded. Gibbon, however, was fortunate in his two cases not to have the pleura injured, which is of great advantage, preventing much of the danger from infection.

The symptoms following a penetrating wound of the heart vary greatly under different conditions. There are always varying degrees of shock which depend largely upon the size and character of the wound. If the pleura is opened and the wound is sufficiently large extensive hæmorrhage may take place into the pleural cavity. Or, on the other hand, blood may pour out into the pericardium or externally. Auscultation produces a variety of symptoms, such as a splashing sound, indicating air and blood in the pericardium: sometimes a friction sound will be noticed, and in other instances a bruit, as though an aneurism existed. The heart's action is irregular and often very labored. The pulse may be less than 100. If the blood is confined to the pericardium the præcordial dulness will be greatly increased on percussion. (Upon these facts I based my diagnosis in the case which I here report.) The pulse will be very feeble and the apex-beat can be neither felt nor heard. The pressure manifests itself first on the auricles and the origin of the great veins, causing venous stasis, which may manifest itself by dyspnœa and cyanosis, the ventricles having a tendency to pump themselves dry, and the heart finally ceasing to act. Without surgical intervention the individual will die from anæmia, compression of the heart, or, later, from sepsis or functional incompetence.

From what has been surmised it would appear that the diagnosis of wounds of the heart could be made without much difficulty. But at times a positive diagnosis can only be determined upon by an exploratory operation. For instance, in punctured wounds involving the præcordium where the internal mammary and intercostal arteries are injured a violent hæmorrhage may ensue which may confuse the condition, with that of a penetrating wound of the heart. The size of the wound of entrance is no index to the size of the wound in the heart, which may be greatly increased either owing to the heart's action or to the position and movement of the wounding instrument.

Stewart quotes Fisher, who analyzed 452 heart wounds, and says that from 7 to 10 per cent. of these cases recover spontaneously. This estimate seems high, but even if it were positive it should not deter one from prompt surgical intervention if the patient's condition warrants it. The prognosis in these injuries depends upon the kind and extent of the wound inflicted, and last, but in no wise least, upon whether or not there is infection, especially of the pleural cavity. Gibbon, in an unpublished paper, is disposed to think from an analysis of the reported cases that gunshot wounds of the heart would give a higher recovery rate than stab-wounds, if it were not for the injury of other viscera which nearly always accompanies gunshot wounds, especially injury to the lung and pleura. There are 19 cases on record where bullets have lodged either in the heart muscle or cavity, and in which the patients have lived for varying periods after receipt of the injury. It may be fair to presume that an individual who lives a couple of hours after the receipt of a heart wound has a fair chance to recover with an operation. Many cases which succumb in a short time, would recover if they could have prompt surgical intervention.

In operating on these cases an anæsthetic seems imperative. Except when the patient is unconscious ether is unquestionably the anæsthetic to be preferred. Time is an important factor, and every provision should be made beforehand so that the steps of the operation may go on without any interruption. As

to the incision for the exposure of the heart, this depends in a measure on the exigency of the case. If possible the incision should be so planned as not to involve the pleura. It is questionable, however, if any operative technique will ever be established for dealing satisfactorily with these cases. The formal osteoplastic flap, as employed by the Continental surgeons for exposing the heart, is liable to result in injury to the pleura, and is not to be classed with the simple suprapleural operation where two or more costal cartilages, and if necessary, a portion of the rib, can be divided and reflected back over the sternum. With care the pleura and pericardium are easily separated from the overlapping tissues, giving the operator every facility to open the pericardium without involving the pleura. In my own case I erred by following the course of the wound through the pleura, thus causing immediate collapse of the lung, and forming later a favorable field for infection. After a satisfactory exposure of the pericardium it should be opened with a blunt pair of scissors, after carefully raising the pericardium from the heart with forceps, as the latter will be floated or pushed forward if much hæmorrhage has taken place, into the pericardium. Loose blood and clots should be quickly sponged out, when usually the bleeding spot can be felt or seen, and controlled by pressure until sutures can be introduced.

The best suturing material is chromicized catgut, reasonably fine, introduced on a sharply curved needle. Each stitch should be left long after tying, as the ends materially assist as tractors and enable the more accurate introduction of the subsequent stitches. It will be found in many cases that the heart's action is very rapid and erratic, and that the introduction of the first suture is like attempting to perform the same operation in the back of a fish which has just been taken from the water and is still impaled on the hook. In ventricular wounds the sutures should be inserted deeply, even to entering the endocardium, as only by this means can accurate approximation be procured. In wounds of the auricle through-and-through sutures are imperative, as well as several superficial ones, as bleeding sometimes takes place through the suture wound, as experienced

in my case. This, however, can be easily controlled by a few superficial stitches inserted at the bleeding point. In introducing the sutures everything should be sacrificed in order to obtain accurate approximation of the wound. If the line of suture should involve the coronary artery little harm is likely to result if it is caught in the suture. This occurred in Gibbon's case without ill effect. Ricketts also showed in experimental work on the dog that either coronary artery could be tied without harm.

In wounds where the lung is also injured considerable bleeding may take place from the lung substance, but when there is an opening of any size in the pleura the lung invariably collapses. This in itself may be sufficient to control the bleeding point. This failing, however, several deep sutures may be inserted into the lung substance at the bleeding point and firmly tied. The pericardium should be closed with a continuous cat-gut suture without drainage, as this cavity is much less apt to become infected than the pleura, and it is the best practice to close the pericardium in this way, although it is just the reverse with the pleura. If the lung is collapsed, the pleural cavity if possible should be cleansed of all free blood and clots, and if the patient's condition admits, provision should be made for drainage by an opening in a dependent part of the chest. No power can prevent infection in a wound where air is drawn into the pleura with each inspiratory act.

It will be also noticed that when the heart has lost its natural support by the surrounding lung, owing to its collapsing, it will immediately begin to become more erratic in its action and to race in a most excited manner. This can, in a great measure, be overcome by loosely packing the large space with liberal pads of gauze wet with salt solution. This was very noticeable in my case, and it seemed as though the heart would almost jump out of the chest until surrounded and supported by the moist packs of gauze.

The after-treatment of these cases is simply routine, in which small doses of morphia may be employed to advantage.

W. W., aged twenty-one, colored, longshoreman, was ad-

mitted to the Pennsylvania Hospital on June 9, 1906, with a stab-wound of the left chest, in third interspace to the left of the sternum, inflicted with a long-bladed pocket knife. The wound was about $\frac{1}{2}$ inch in length. On admission the patient was somewhat shocked but did not complain much of pain. After being placed in bed reaction took place, and when seen by me two hours later the heart's action was fairly good; the pulse was about 120 and could be readily felt at the wrist. On auscultation, however, it could be seen that the heart was laboring very considerably, the sounds being very indistinct and muffled. The præcordial dulness had very much increased and had been gradually doing so since his admission, as noticed by Dr. Drayton, the resident physician, and it was very evident that the knife had entered the pericardium and wounded the heart. Operation was immediately decided upon. The patient was etherized and an incision about 4 inches long made to the left of the sternum, following the line of the wound, which had opened the pleura. The two ends of the fourth and fifth costal cartilages were removed from their attachment to the sternum, which, with the aid of a retractor, freely exposed the pericardium. It was noticed that the lung was partially collapsed, and the heart was laboring very much within the exposed pericardium. The pericardium was freely incised and found full of clot, which was rapidly removed and a wound about $\frac{1}{2}$ inch in length found in the left auricle, from which a stream of blood squirted to a height of about 9 inches. The heart's action on the removal of the clot became fearfully rapid, and it was with the greatest difficulty that a number of sutures were introduced into the auricle, which was finally closed with chromicized gut. It was rather curious to note that immediately on the introduction of the first stitch the size of the blood stream from the auricle was reduced, but in place of one stream there were four, two small ones coming from the needle wounds. Two stitches were introduced through and through the auricle and these had to be fortified by a number of superficial stitches. In a few minutes all bleeding was permanently controlled. After thorough cleansing of the pericardium it was sutured. Apparently owing to the lack of support which the heart did not receive from the collapsed lung, its action was very violent and erratic. Two large section pads were placed behind the pericardium saturated with normal salt solution, and

the heart and respiration immediately became more normal. One pad was placed on top of the pericardium and brought out through the incision. The lower end of the incision was approximated with silk-worm gut. The patient reacted well from the operation. Subsequent to operation his pulse was of rapid but fair quality, about 120 to 140, and respirations ranged from 56 to 72.

The third day after operation the pads were removed and the patient's general condition was good. The following day the superficial drain was removed and another inserted; the left chest was strapped, which materially assisted the breathing. It was very evident that infection had taken place in the chest, as the discharge became very profuse and foul. On June 29 a rib was resected and a drainage tube inserted in the posterior axillary line. For some reason this did not drain satisfactorily. On July 3 another incision was made and the seventh and eighth ribs were resected in the postscapular line, and a tube inserted, but this did not in any way relieve the condition, and shortly after the removal of these two ribs the patient died.

The autopsy showed an empyema of the left chest, which drained badly. The left lung had collapsed, and was the seat of a bronchial pneumonia. The right chest contained 11 ounces of bloody fluid, and there was also a bronchial pneumonia of this side. There were extensive pericardial adhesions with no sign whatever of the stab-wound. The endocardium and valves were healthy.

HERNIA OF STOMACH THROUGH THE DIAPHRAGM INTO THE THORAX.

BY G. S. GORDON, M.D.,

OF PHOENIX, BRITISH COLUMBIA.

THE following case is reported as a contribution to the literature of diaphragmatic hernia:

The patient, a man thirty-one years of age, nothing notable in his family history, was well until six years ago when he was stabbed in the left flank. He is a horseshoer by trade. He weighed at onset of illness 175 pounds, and used tobacco to excess.

His present illness dates back four years; and the symptoms have been about the same since, varying only in degree of severity. His sister says he always had "a weak stomach." Knife-like pain over short ribs of left side extending to left shoulder tip and occasionally down left arm; was relieved by a fakir some months ago by well rubbing in some secret remedy. This pain was worse when stooping over shoeing horses, and with it was associated a bloating of the epigastrium and distress in the epigastric region. All symptoms improved on vomiting an acrid sour material five minutes to one hour after eating. Vomitus never contained blood or was of coffee-ground appearance. Condition is worse now, but on some days he is quite free of vomiting. He once discontinued the use of tobacco for a month, with some benefit. He lies easier on the left side. Has always been constipated. Tachycardia is troublesome at times.

Present Condition.—A walking skeleton; weight about 90 pounds; skin dry and harsh; abdomen scaphoid and easily palpated without tenderness throughout. An under-exposed skiagraph after a dose of bismuth showed a largely dilated stomach and the œsophagus; but little reliance was placed on the interpretation of this. He eats mostly solids, and sometimes retains shredded wheat biscuit and bacon while liquid foods are immediately returned. Test vomitus was unsatisfactory for examination, as food was (on occasions when specimens were saved) returned almost as soon as swallowed. Obstinate constipation. Lungs and heart normal. Temperature slightly subnormal.

Operation.—The duodenum was identified about in mid-line of abdomen, but no stomach in sight. It was brought down by traction through the œsophageal opening in the diaphragm, which was large enough to admit three fingers to the second joint. The stomach was hugely dilated and of hour-glass form. Gastro-enterostomy (Mayo's) was done, attaching the proximal end of the hour-glass to the jejunum, with the hope that reduction of the hernia and gastrojejunostomy would keep the stomach in place. The cicatrix of the old stab wound intraperitoneally showed nothing bearing on the condition.

Post-Operative Course.—The first twenty-four hours were uneventful except that slow salines per rectum were not retained. Late the second day beer was rejected by mouth and thereafter only occasionally was liquid nourishment retained, and later not even hot water was tolerated. Salines were given subcutaneously. He sank rather suddenly on the fourth day. When preparations for a jejunostomy were complete he was moribund. The temperature had remained subnormal throughout and not till the night of the third day did the pulse flag or run above 72. No blood was passed by rectum or mouth.

Post-mortem autopsy revealed the stomach in part returned through the diaphragmatic opening into the thorax. On slitting the diaphragm the stomach was found lying free in the pleural cavity with the left lung. Operative wounds looked well. The hour-glass constriction was a narrow fibrous band most marked on the epiploic border and was probably the junction at one time of the thoracic and abdominal sections of the stomach. Four years ago it would seem as though the whole stomach had become a thoracic organ. It would seem that the diaphragm was so depressed that the stomach was very nearly at its normal level, and plenty of room was thus left for the expansion of the left lung. Treves states diagnosis of diaphragmatic hernia is easily made. Several skilful diagnosticians were misled in this case. No literature at my disposal deals with the surgical treatment of these cases.

Had time permitted, the stomach might have been stitched to abdominal walls. Stitching of the stretched œsophagus to the œsophageal opening in the diaphragm hardly seemed feasible (even post-mortem), owing to the high level to which it retreated when the stomach was brought down. Jejunostomy alone might have been done, and, later, when the patient was fed up, other operative measures taken with better chance of success.

NOTE ON CARCINOMA OF THE CARDIAC END OF THE STOMACH.

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AFTER looking over the cases reported in the past ten years it seemed that primary carcinoma of the cardiac end of the stomach was comparatively rare. On that account and also from the interesting relationship of the physical conditions to operative procedures, the following case is reported rather fully. I am indebted to Dr. Harvey G. Mudd for permission to present the case, as it was a patient under his charge:

J. E. C., male, white, 50 years old, American. No history of cancer in the family; history otherwise good. Has never had any illness, always strong and healthy. In September, 1905, the patient noticed that there was a burning sensation in the epigastrium after eating and after drinking hot fluids. In October he noticed that if he ate certain things he would vomit them. Was obliged to live on soft foods, as they were not accompanied by pain. In December he observed that after eating he had a throbbing pain in the epigastrium. At this time he was vomiting at intervals but never brought up blood or "coffee grounds." In May he vomited a piece of red flesh-like material with something that resembled skin covering its surface. On June 17 he vomited another similar piece. The first time that the patient noticed any difficulty in swallowing was in December, 1905. Since then he has been growing progressively worse and has been compelled to live on liquid food. In the past six months he has lost about fifty pounds.

Physical examination shows a thin, somewhat emaciated man. Skin is rather pigmented. Abdomen is very scaphoid. No tumor can be felt on palpation. Percussion note over the abdomen is rather flat on account of there being little or nothing

in the intestines. Stomach does not seem enlarged nor is any mass apparent.

On June 19, 1906, the man was operated upon, and a gastric fistula was made. Liquid food was administered by means of a rubber tube, but little was retained as it escaped both through and around the tube.

On account of the inability to retain food he became gradually weaker until July 14, when he died.

A very limited post mortem was made some eight hours after death. The body was that of a much emaciated adult white male. Abdomen scaphoid. In the left nipple line just below the margin of the ribs was an open incision about an inch and a half long. On opening the abdomen the stomach was found to be very small and displaced so greatly to the left side that the pylorus was to the left of the mid-line. The edges of the opening into the stomach were firmly adherent to the edges of the abdominal incision. It was seen that the opening made during the operation was not much more than an inch from the pylorus. The stomach was also found to be so tightly bound down by adhesions at the cardiac end to the diaphragm that it could not be dragged to the right side.

Palpation showed the presence of a dense mass at the cardiac end of the stomach, extending into the œsophagus for a couple of inches. The stomach, about an inch and a half of the œsophagus and a small portion of the duodenum were removed. On opening the stomach a tumor mass was seen at the cardia. Its surface was very irregular, generally pale in color, but interspersed with numerous minute areas varying in color from bright red to dark brown. The œsophagus was larger than normal and so filled with new growth that it was difficult to get a 0.5 cm. glass rod through into the stomach. Above the tumor the œsophagus was markedly dilated and filled with a large amount of brownish and extremely offensive fluid.

The dimensions of the stomach were as follows: Distance from œsophagus to pylorus, 11 cm.; greatest diameter, 18 cm.; width of the growth at the cardia, 5 cm.; circumference, 9 cm.; and diameter of œsophagus, 3.5 x 4 cm.

The microscopic report was as follows: The amount of connective tissue in the specimen is comparatively slight, existing merely as narrow branching bands separating the epithelial

elements. This tissue is everywhere greatly infiltrated by cells containing small round deep-staining nuclei. Throughout the specimen are nests of varying sizes and shapes composed of cells containing rather long and narrow nuclei that stain quite deeply with the hæmatoxylin. The amount of protoplasm is small and stains faintly with eosin. Besides the nests of cells there are found well marked acini, the openings of which vary greatly in size and shape. Surrounding these openings are cells that appear distinctly columnar in character. The nuclei are long and narrow and are situated at the basal end of the cell. These cells are, however, not restrained by a basement membrane, and in many places can be seen penetrating the surrounding tissues. There is also little regularity in the arrangement of the cells; they differ considerably in size, and in many places are two or three layers thick along the edge of the acini. The larger acini contain masses of granular matter, leukocytes, red blood corpuscles and cells that appear to have desquamated from the lining epithelium.

Diagnosis was malignant adenoma.

The post-mortem findings explained the reason for the leakage of fluid from the stomach after the operation. The incision had been made in the left nipple line, hoping that it would enter the stomach at a sufficient distance from the pylorus to allow of the retention of fluid. As is usually the case in cancer of the cardia the stomach was much diminished in size, and on account of dense adhesions was markedly displaced to the left. In consequence of these conditions the opening into the stomach was located about an inch from the pylorus.

The size of the stomach depends upon the permeability of the opening of the œsophagus, and as in this case there was almost complete obstruction the reduction in size would naturally be extreme.

A clinical diagnosis as to the location of the primary growth, whether descending from the œsophagus or ascending from the stomach, cannot often be made. In this case the microscopic findings show that the tumor is of a type essentially belonging to the region of true glandular epithelium.

According to the statistics of the Middlesex Hospital¹ there were in fifty years (1854-1904) 227 cases of carcinoma of the stomach, in 19 of which the growth was located at the cardiac end. Of these 13 were in males and 6 in females. Two of the cases showed extension for a short distance into the œsophagus. The average ages were 38 in females, 49 in males.

Osler and McCrae² in a series of 150 consecutive cases of carcinoma of the stomach, mention two in which there was involvement of the cardia with extension into the œsophagus. One of these had, however, evidently originated elsewhere in the stomach than at the cardia, and had merely involved it in the extension of the growth. Both cases were males 61 years old. Habershon³ found that in 79 cases of gastric carcinoma examined at Guy's Hospital there were 10 in which the cardia alone was involved. Perry and Shaw,⁴ in a series of 46 cases, found 4 of the cardia.

Anders⁵ reports a case in a white man 54 years' old. There was a history of five months' duration in which time the patient suffered from nausea after meals and then vomiting of undigested food. Operation revealed a carcinoma of the cardia with a moderate degree of stenosis. There was also some involvement of the lesser curvature and a small part of the anterior wall. Secondary nodules were present in the right lobe of the liver.

Martin and Roberston⁶ published the following case: Patient was 50 years' old, weak and emaciated; abdomen was retracted; there were nodules on liver. Ingestion of solids was impossible. At autopsy there was found a diffuse carcinomatous infiltration of the cardia and lower end of the œsophagus. Secondary nodules were found in the liver, omentum, the capsules of the kidney, adrenals, pancreas, diaphragm and the renal and peri-bronchial nodes. The microscopic diagnosis was malignant adenoma (cylindrical-celled carcinoma).

McCaskey's⁷ case was a white male 40 years' old. The trouble lasted one year; death took place at the end of seventeen months. The patient had had pain after eating, and although at first there was loss of weight, this was followed by an increase. The blood examination on two occasions showed 6,000,000 red cells, 15,000 white, and 5,500,000 red, 10,000 whites, 110 per cent. hæmaglobin. Autopsy showed that the "stomach was not greatly enlarged; the capacity was about 1,200 c.c." Both pyloric and cardiac ends were involved, while the intervening portion was free. Microscopic diagnosis was adenocarcinoma.

The following are the notes on a case reported by Limard.⁸ The

patient, a man 45 years' old, had been healthy until about six years before presenting himself for treatment. His disease was first manifested by pain and burning in the stomach which took the form of attacks lasting from four to six weeks. These attacks were followed by periods of some months of freedom from pain. The pain finally became continuous. The stools were frequently black; deglutition became difficult and at last only liquids could be swallowed. The patient was operated upon, with recovery. At the time of the operation the case was diagnosed as cancer of the cardiac orifice extending into the lesser curvature.

Fawcett⁹ showed a case in which the cardiac opening was occluded and the walls of the stomach, including the mucosa and the sub-mucosa, were involved. The lower four inches of the œsophagus was dilated. Diagnosis was adenoma malignum.

In those cases in which a microscopic diagnosis was made the tumor was of the type of adenocarcinoma. According to the figures obtained by Kappers and von Roojen¹⁰ from the examination of 106 cases of carcinoma of the stomach the above variety formed 39.2 per cent.

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A CRITICAL REVIEW OF A RECENT SERIES OF OPERATIONS UPON THE STOMACH.*

BY GEORGE EMERSON BREWER, M.D.,

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IN a paper read before the Hartford Medical Society one year ago, entitled "The Surgical Treatment of Chronic Dyspepsia," the writer reviewed the subject of gastric surgery, spoke of the evolution of our modern methods and technic, quoted the most recent statistics from many of the best European and American clinics, and among other conclusions stated that the "indications for treatment in benign lesions of the stomach are:

"First, Intelligent medical treatment in all primary cases of simple round ulcer. If unrelieved after six weeks of this treatment, operation should be advised.

"Second, Operation in all cases of indurated chronic ulcer, and in all cases of recurrent symptoms after a primary cure.

"Third, Operation in all cases of pyloric stenosis, excepting those due to gummatous infiltration."

Undoubtedly the most brilliant results have been obtained in cases of chronic indurated ulcer and benign stenosis of the pylorus, and these contrast so strikingly with the almost universal failures which followed the dietetic and medical treatment of these conditions, that to-day the great majority of intelligent medical practitioners advise operation in those suffering from these lesions.

The honest enthusiasm which naturally follows great achievements in a new field of surgical endeavor, almost always results in the pendulum swinging too far, and the application of surgical therapeutics to unsuitable cases, or to those in which the diagnosis is not accurately established.

* Read before the New York Surgical Society, January 23, 1907.

I myself must plead guilty to some of these therapeutic transgressions, and it is my purpose this evening to report a recent series of operations upon the stomach for presumably benign lesions, in which several errors in judgment are to be recorded. It is my hope that by a candid analysis of these cases, and by suggestions which I may glean from your discussion, I shall be able to avoid these errors in the future.

During the past twelve months the writer has performed 16 operations for symptoms thought to be due to chronic gastric ulcer or benign pyloric stenosis. One other case will be included in this series, which occurred in the writer's service but was operated upon by another surgeon, making 17 in all.

In reviewing the histories of these cases I have been struck with the fact of a rather large percentage of failures to relieve the symptoms from which the patient sought relief—much larger, in fact, than in any previous year. Whether these failures have been due to faulty technic, to bad judgment in the selection of cases, or to errors in diagnosis, I will leave for my hearers to decide.

For convenience I shall divide the cases into two groups, those in which a definite anatomical lesion was demonstrated, and those in which no lesion was found. In the first group there are 12 cases, of which 11 recovered and were immediately relieved of their symptoms, and 1 died on the sixth day from pneumonia. Of the 11 which were immediately relieved of their symptoms, 9 are known to have remained well, 1 died six months later, probably of malignant disease, and 1 other continues to suffer and has lost weight. Of the 5 cases in which no lesion was found at operation, 1 was immediately relieved of an hysterical pseudo-tetany, 1 died from persistent vomiting, 1 continued to suffer from the gastric crises of locomotor ataxia, and 2 from symptoms which could only be classified as a gastric neurosis.

Of the twelve patients in Group I:

CASE I.—Was that of an unmarried woman forty-three years of age, referred by Dr. Robert C. Kemp. Two years before admis-

sion she suffered from epigastric pain after taking food, acid eructations, sour vomiting, with rapid loss of flesh and strength. An ulcer cure, consisting of rest, rectal feeding, careful regulation of the diet and appropriate medication, resulted in a complete relief of symptoms for more than a year. The symptoms, however, finally recurred with great severity; extreme agonizing pain, persistent vomiting and a loss of over fifty pounds in weight. The diagnosis of open gastric ulcer was confirmed by repeated gastric analyses. Gastro-enterostomy, short-loop suture method, was followed by immediate relief. Patient gained rapidly in weight (16 pounds in one week) and has since been able to digest without pain or discomfort all kinds of solid food. Total gain in weight in one year, 104 pounds.

CASE II.—Was that of an unmarried female fifty years of age. Painful digestion, sour stomach and occasional vomiting for three years. Six months before admission the vomiting became more frequent and often contained food taken several days before. Rapid loss of flesh and strength. Exploratory operation in a neighboring city; diagnosis, pyloric cancer, abdomen closed. She continued to vomit everything taken into the stomach, became extremely emaciated, weak and anæmic. Gastric analysis showed only evidences of dilatation and stasis. At operation, a large inflammatory induration around pylorus was found. Gastro-enterostomy, short-loop suture method. No reaction following operation. Liquid food on second day, solid food at the end of ten days, with no pain or discomfort. A recent communication states that she has gained 40 pounds and is in perfect health.

CASE III.—A man forty-nine years of age. Dyspepsia ten years ago, lasting one year. Symptoms of open ulcer three years ago, with a gradually developing pyloric stenosis. Has suffered extreme pain at times, and has gradually eliminated all solid food from his diet. For past four months has subsisted only on milk. Of late the vomiting has been daily and often copious. A meal of scraped meat and bread caused agonizing pain for five or six hours. Gastric analysis suggested stasis and open ulcer. Loss of 40 pounds in weight. Gastro-enterostomy. Complete relief of symptoms. In three weeks the patient was able to eat solid food, including meat, fish, bread, vegetables, tea, coffee, etc. Later report states that he is now perfectly well—has gained 10 pounds.

CASE IV.—Male, twenty-four years of age. Dyspepsia for six months. Symptoms consisted of epigastric pain and burning after taking food, occasional sour vomiting and acid eructations. Loss of 25 pounds in weight. Gastric analysis indicated high acidity. No stenosis. Gastro-enterostomy, followed by immediate relief of symptoms. Later report: Health good; digestion perfect; gain of 25 pounds in weight.

CASE V.—Female, thirty-five years of age. Duration of symptoms three years. Pain after eating, marked burning sensation and tenderness at epigastrium, some vomiting, loss of weight, hæmatemesis. Gastric analysis showed moderate hyperchlorhydria. Gastro-enterostomy; indurated pyloric ulcer found. Prompt operative recovery, marked improvement in symptoms. A later report, however, shows that the symptoms have returned and that the patient is losing ground. Physical examination reveals a large, hard epigastric tumor. Patient advised to re-enter hospital for observation.*

CASE VI.—Male, twenty-eight years of age. Hard drinker. Three years ago symptoms of alcoholic gastritis, morning vomiting, etc. Later, symptoms of open ulcer, pain, some vomiting and heartburn. For past six months symptoms of pyloric stenosis, frequent vomiting of food taken day or days before. Gastric analysis showed stasis and fermentation. Loss of weight and strength. On operation, pylorus found angulated and closely adherent to liver by dense adhesions. When these were divided the stomach dropped into place and the pylorus seemed normal in size. Immediate relief of vomiting. Patient discharged on eighteenth day able to eat solid food with comfort. Later report: Gain of 25 pounds; digestion perfect.

CASE VII.—Male, fifty years of age. Dyspepsia for six years. At first pain, sour stomach, heartburn and occasional vomiting with relief of pain. For past year vomiting more frequent, rapid loss of weight and strength. Gastric analysis showed marked hyperchlorhydria. On operation, pylorus found indurated and adherent to pancreas. Gastro-enterostomy, with immediate relief of symptoms. Later report: Excellent health; gained 25 pounds.

* This patient entered hospital and was observed for several days—gastric analysis shows complete absence of hydrochloric acid after a test meal. Is now undergoing treatment by tripsin. Diagnosis, carcinoma.

CASE VIII.—Male, twenty-seven years of age. Seven years ago severe dyspepsia lasting one year. Then a period of four years elapsed without symptoms. Two years ago a return of dyspeptic symptoms with epigastric pain and tenderness. Ten months ago severe hæmatemesis. Treated in medical division of Roosevelt Hospital with marked relief. Five months later a second hæmatemesis, less severe. This was followed by a return of his digestive symptoms, chiefly pain. Gastric analysis showed high percentage of free hydrochloric acid. On operation, stomach so bound down by adhesions that suture operation could not be performed. Posterior gastro-enterostomy by Murphy button. Complete relief of pain. Discharged in twenty-two days, eating solid food without discomfort. Later report: Patient is working every day; has had no vomiting or hæmorrhage; still has pain after solid food.

CASE IX.—Female, forty-three years of age. Duration of symptoms only a few weeks. Complained of severe epigastric pain with fever and vomiting. Later, pain became less severe, but vomiting continued. Treated in medical division of hospital for several weeks. Vomiting continued. Referred to surgical division for exploratory operation. On opening abdomen, large inflammatory induration of first portion of duodenum found. Gastro-enterostomy; immediate relief of pain and vomiting. Was later able to take and retain all kinds of food. Left hospital on nineteenth day after operation. Later report: Health excellent; no pain or vomiting since operation.

CASE X.—Male, thirty-two years of age. Four years ago had sudden severe pain in epigastric region. This was followed by severe dyspepsia for two and one-half years. The pain was more marked one or two hours after taking food. Marked relief when he would starve himself. Vomiting of sour material would generally relieve pain. On two occasions he has vomited blood and passed black stools. From January, 1905, until July, 1906, was free from symptoms. For past four months experienced a return of the pain and vomiting, with loss of weight and strength. Gastric analysis shows hyperacidity. On operation, pylorus was thickened and surrounded by dense adhesions. Gastro-enterostomy was followed by marked relief. Patient left hospital on twentieth day able to eat solid food without discomfort. Later report indicates complete return to health.

CASE XI.—Male, thirty-seven years of age. History of gastric ulcer confirmed by gastric analysis. Apparently relieved by Leubé ulcer cure. Return of symptoms, for which second cure was recommended. During this treatment patient became gradually weaker and progressively anæmic. At first traces of occult blood in stools, then blood in larger quantities, and finally the entire fæcal discharge would appear dark and at times tarry. No gastric analysis made at this time. Operation revealed large indurated area along lesser curvature, strongly suggesting carcinoma. Gastro-enterostomy. Patient was starved for forty-eight hours and then given water for four or five days, finally broth and solid food. Stools frequently examined, no blood found at any time subsequent to operation. Marked improvement in appearance. Hæmoglobin increased from 45 to 70 per cent. Patient remained in hospital fifty-seven days and was discharged able to take solid food in abundance without any discomfort. A few weeks after leaving the hospital the patient began to lose appetite and strength; later, digestive trouble appeared. A diagnosis of tuberculosis of the stomach was suggested by an eminent specialist. He died six months later of symptoms strongly suggesting malignant disease.

CASE XII.—Woman, forty-five years of age. Three years ago began to have symptoms of open ulcer, pain, some vomiting, belching of gas, etc. The attacks would come on and last for a variable period. For last years the pain has been growing worse and the vomiting more profuse. Loss of 40 pounds in weight. Gastric analysis shows marked hyperchlorhydria. Operation showed old scars near pylorus. Gastro-enterostomy. Hæmatemesis immediately after operation. On fourth day lobar pneumonia developed; death on sixth day.

It will thus be seen that in all cases in Group I a definite anatomical lesion was present, and in each case the operation was clearly indicated. In all of the gastro-enterostomy cases, the posterior no-loop operation was performed, and in ten of the twelve the suture method was followed. In no instance was there any evidence of functional disturbance due to the side-tracking of the duodenum. In no case was there any evidence of sepsis or peritoneal irritation, and none of the cases showed

post-operative shock. In the only fatal case of the series a severe hæmorrhage occurred in the stomach immediately after the operation and gave rise to frequent vomiting of fluid blood and clots. This, however, soon ceased, and although there was a rise of temperature to 102 degrees the night following the operation, it gradually fell to normal. On the fourth day, after the patient had rallied from the hæmorrhage and was taking liquid food, she developed a lobar pneumonia of an extremely toxic type, and died in forty-eight hours. At no time was there any sign of peritoneal irritation or interference with the functional success of the anastomosis, as she took and retained, during the last three days, liquid food in abundance.

At first I was at a loss to account for the hæmorrhage, but after conferring with my house staff, I am inclined to think that in making the anastomosis the site of the jejunal opening was not, as it should be, immediately opposite the mesenteric border where the vessels are small and easily controlled by the lock stitch, but on one side nearer the mesentery, for I distinctly recall that after removal of the clamps, there was considerable oozing from the last line of sutures, which was with considerable difficulty controlled. This hæmorrhage undoubtedly weakened the patient, and lowered her normal resistance to the pneumococcus infection.

In Case XI the patient that died six months after operation of tuberculosis or cancer, we were unable to arrive at any accurate diagnosis during life. Had the patient been in better condition, we would undoubtedly have removed a small portion of the indurated mass for microscopical examination, but as his condition was critical in the extreme from prolonged hæmorrhage, we felt the necessity of avoiding any procedure which would prolong the operation. The case illustrates very forcibly the remarkable effect which rapid emptying of the stomach had upon an ulcerative process of unusual virulence.

We now come to the consideration of Group II, in which no definite lesions were found at operation.

CASE I was that of a spare, neurotic man, fifty-seven years of age, who had suffered for many years from chronic dyspeptic symptoms. Operated on for gall-stones one and one-half years ago; no relief. Now complains of loss of appetite and sense of weight at epigastrium after taking food, sour eructations, belching of gas and obstinate constipation. He often feels a movable hard lump in epigastric region, which he insists is growing larger. This, however, was not verified by our examination. Gastric analysis after a test meal showed total acidity to be 123, free hydrochloric acid 84. Abdomen opened, no definite lesion found, only a slight thickening at pylorus. Posterior gastro-enterostomy. No reaction. No discomfort until he began to take liquid food. He then began to vomit, at first only the food taken, later the vomiting became frequent of large quantities of dilute gastric juice and mucus, and finally intestinal matter. Pulse and temperature remained normal, abdomen flat, no tenderness or rigidity. About the fourteenth day after operation the patient's condition became so critical that the abdomen was reopened. There was no peritonitis, the anastomosis was perfect, the duodenum was not dilated. Abdomen closed, the vomiting continued until death from exhaustion three or four days later.

CASE II was that of a female thirty-one years of age, who gave a distinct history of ulcer in early life, which was apparently cured. For past three years she suffered from digestive disturbances of various kinds, resulting in frequent attacks of nausea and vomiting with pains in the epigastrium and in the left inguinal regions. Operated upon one and one-half years ago for uterine prolapse. For past two months she has lost weight, had severe pain after eating, belching of gas, and frequent attacks of sour vomiting. Gastric analysis showed on two occasions no free hydrochloric acid after a test meal, once it was 24, and again only 9. There was distinct epigastric tenderness. Loss of weight 15 pounds in eight weeks. The patient had been under a severe mental strain, and was decidedly neurotic.

After two consultations it was decided to make an exploratory operation, as she was evidently losing ground. On opening the abdomen nothing abnormal was found, but the symptoms so strongly suggested ulcer that a gastro-enterostomy was performed. During her convalescence, which was uneventful, she

seemed much more comfortable. While on a limited quantity of liquid food she did not vomit and had little pain. As soon as she left the hospital, however, all the old symptoms returned with even greater intensity. She became depressed, lost weight and strength, and was obliged to limit her diet to a few simple articles of food; and even then she had frequent attacks of prolonged and exhaustive vomiting with pain on the left side, extending from the costal border to the groin. Ten months after leaving the hospital she was readmitted for observation and further treatment, as her symptoms suggested a vicious circle.

During three weeks she was kept in bed and carefully observed. At no time was there any bilious vomiting. She would often reject her food shortly after swallowing it, and at other times would go several days without vomiting. A full meal of solid food would often be retained and digested without discomfort, and again small quantities of broth or farina would be immediately rejected with great quantities of gas and pain. Several test meals were given and expressed at varying intervals. The result of these investigations showed that the stomach emptied itself promptly and that there was no marked hyperchlorhydria. There is apparently a tendency toward gastrosuccorhea, as on one occasion after a fairly full meal at bed time, nearly a pint of gastric juice and mucus was removed in the early morning, but with no bile or food remnants. The patient has alternating periods of mental elation and depression. It is chiefly during the latter that she vomits and complains of pain. On the whole, she was somewhat benefitted by her stay in the hospital. She was seen in consultation by Dr. James, who, after a careful review of the history, agreed with the writer that the case was probably one of a gastric neurosis which had been made worse rather than better by operation.

CASE III.—A man, forty years of age, complained of severe pain in the epigastric region, with tenderness and frequent vomiting. These symptoms first appeared five months before admission, but were relieved by internal treatment. Later the symptoms recurred with great severity and at one time he vomited a large amount of black coffee-grounds material. The pain was increased by taking food and would often be relieved by vomiting. Has lost 10 pounds in weight. Gastric analysis showed nothing abnormal. He was seen by a number of the staff of the hospital.

It was thought by some that a mass was felt in the region of the pylorus. The severity of the symptoms led to an exploratory incision. Nothing abnormal was found, but a posterior gastro-enterostomy was performed. The convalescence from the operation was uneventful, but there was practically no change in the symptoms, which were undoubtedly the gastric crises of a locomotor ataxia.

CASE IV.—An emaciated neurotic female, twenty years of age, was transferred to the surgical division of the Roosevelt Hospital, after the medical department has exhausted every resource at their command in an attempt to check or lessen a prolonged period of persistent vomiting. Three months before admission she began to complain of pain after eating, which was followed by vomiting. The symptoms increased in severity. She was obliged to subsist upon liquid diet. Later, the vomiting would occur as soon as any food was taken. She lost strength and flesh rapidly, was constipated and suffered from constant headache. Gastric analysis showed a slight increase in the amount of free hydrochloric acid. Loss of weight 41 pounds in three months.

Upon opening the abdomen nothing abnormal was found, but a gastro-enterostomy was performed in the hope that the symptoms were due to ulcer, and would be relieved by stomach drainage. The operation was easily and quickly performed and she had no untoward symptoms until the following day, when there occurred a rather copious hæmorrhage from the cutaneous wound. This was repeated two or three days later and very much alarmed the patient. Prior to this last hæmorrhage, there had been very little vomiting, although she had taken water and a little milk. After the hæmorrhage, however, she lost heart, said she would surely die, whined and cried day and night, and made no effort to help herself in any way. She vomited at least three-quarters of the food taken and on several occasions flatly refused nourishment. In spite of all these unfavorable factors she made a satisfactory operative recovery, and gradually began to retain a part of the food taken. Every effort was made by the house staff and nurses to induce her to take nourishing food, but much of it had to be administered by force under protest.

About three weeks after the operation she ceased to vomit regularly and would retain the greater portion of the food. The epigastric pain ceased, she said her stomach gave her no trouble,

but she had a pain which extended from the left side of the occiput to the heart and womb. She was obstinately constipated, and as we were obliged to resort to frequent enemas, there occurred a prolapse of the rectum which added to her distress of mind and more than ever convinced her that she was about to die. At present she presents the picture of an utterly wretched and hopeless hypochondriac, although it is only fair to say that for the present at least, the symptoms for which she was operated upon—pain, vomiting and progressive emaciation—have been relieved. I firmly believe, however, that the case was one of a very grave neurosis, which following the operation has manifested itself by other symptoms.

CASE V.—A well nourished man of thirty-five years. Four years ago, while serving in the Philippines, he noticed cramps in the legs after standing for a long time in the rain. These cramps were painful, but were relieved by stamping the feet. A day or two later they became worse and it was noticed that the toes would become flexed and rigid. He entered a hospital and was treated for several weeks for convulsions. He was finally discharged and remained well until three weeks before admission to the medical service of Roosevelt Hospital. On admission, he stated that he had been having violent convulsions six or eight times each day. His legs and arms were sore from the severity of the muscular contractions. The convulsions would begin by extension of the feet, flexion at the metatarsophalangeal joints, then flexion of the legs upon the thighs and of the thighs on the body. The arms would be flexed at the elbows, and carried across the chest, the fingers flexed at the metatarsophalangeal joints with the thumbs buried in the palms of the hands. The face would be contorted. He would not lose consciousness. After from one to fifteen minutes of these violent tonic contractions he would suddenly relax with a groan, and rub the affected muscles. During the period of relaxation the toes remained spasmodically flexed, and the slightest pressure over the tendons or muscles would excite a renewal of the attack. Although he had no symptoms of digestive disturbance, examination of the gastric contents on several occasions showed considerable dilatation and diminished mobility. After several weeks of careful observation and treatment, during which the convulsions became more frequent and violent, he was transferred to the surgical

division for an exploratory operation, on the theory that the case was one of gastric tetany and that there was some pyloric obstruction, either from spasm, inflammatory induration, a new growth. On operation nothing abnormal was found. The anterior wall of the stomach was opened and two fingers forced through the pylorus to insure its patency.

The convulsions ceased immediately after the operation, and he made a satisfactory convalescence. On getting out of bed, however, he was found to have a more or less complete motor paraplegia. He was unable to walk or even stand, and for several weeks made no effort to get about. On being told that he must either go home or be transferred to Bellevue, he angrily arose and walked out of the hospital. The case was evidently one of grave hysteria, and the improvement due wholly to suggestion.

It will thus be seen that of the five cases which make up Group II, in which no definite anatomical lesion was found at operation, one was a case of locomotor ataxia with gastric crises, one a case of hysterical pseudo-tetany, and the other three can only be classified as examples of a gastric neurosis; and while in two of these cases considerable improvement in the symptoms followed the operation, there is little or no reason to ascribe this improvement to the operative procedures. All must therefore be regarded as failures, at least from a surgical point of view.

Taken as a whole, this series of cases teaches, that if one would obtain the best results in this class of patients, he should limit his operative intervention to cases in which the evidence of a definite anatomical lesion is well nigh conclusive, and I can formulate no better rules for guidance than those laid down in the opening paragraph of this paper.

THE LESIONS ASSOCIATED WITH GUNSHOT WOUNDS OF THE STOMACH.*

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FIFTEEN years ago reports of cases of perforating wounds of the abdomen invariably led to a discussion of the advisability of operative interference, and the proper time after the receipt of the injury for such intervention. To-day, no such discussion is in place. In civil practice it has been definitely decided that active surgical interference is imperative, although the experience gained in the Spanish-American, the Boer,^{1 2} the Japanese-Chinese, and the Japanese-Russian³ wars has unmistakably shown the desirability of conservative treatment under the conditions found in military service. Furthermore, the question of when to operate is no longer considered. Immediate laparotomy as soon as the patient can be prepared is, I believe, the rule to-day in the hospitals in America and abroad.

During the last twenty years many reports have appeared of results of the operative treatment of penetrating abdominal wounds. These reports have generally grouped together all penetrating wounds, and the number of cases reported in each series of injuries to any one viscus has not been large. In recent years there has been a tendency to class together cases of injury to each viscus, and to consider separately the mortality and treatment of wounds of liver, stomach, diaphragm, lungs, intestines, kidney or pancreas. Such studies have the great advantage of directing the attention to the peculiarities of the wounds of each organ, and the difficulties likely to be encountered in their treatment. There is, however, the disadvantage, in gunshot wounds at least, that isolated visceral injuries must necessarily be uncommon, and that in the dis-

* Read before the New York Surgical Society, February 13, 1907.

cussion of the lesion to one viscus, equally or even more important associated injuries to neighboring organs are but little considered. For example, a classification which groups under the title of gunshot wounds of the stomach a case in which the bullet has passed through the diaphragm, the lung, the stomach, the transverse colon, and has remained embedded in the pancreas, is obviously unsatisfactory. The stomach injury is no more accountable for the fatal outcome than the associated lesions to lung, colon and pancreas.

My attention has been called to this feature by three cases of perforating wound of the stomach which I have operated on at the Roosevelt Hospital, the first in the service of Dr. Weir several years ago, the second and third recently in the service of Dr. Blake.

CASE I.—This I refer to only for the purpose of contrast. The wound was not caused by a bullet. A young man was stabbed with a knife in the epigastrium. A few hours after the injury the abdomen was opened; a perforation of the anterior wall of the stomach was closed with sutures, and the patient made an uninterrupted recovery.

The second and third cases, both gunshot wounds, I report in detail.

CASE II.—On December 19, 1906, at six P.M., a Chinaman, twenty-three years old, was brought to the Roosevelt Hospital. He had been shot one hour before. He was preparing, at the time, his evening meal, having taken food last at eleven A.M. The shot was fired at a distance of five yards; the weapon used was a 32-calibre revolver. The patient did not vomit or lose consciousness, but bent double and complained of epigastric pain. On admission, his respirations were 36; pulse, 108; temperature, 99° F.

There was a bullet wound over the sixth intercostal space, 7.5 cm. below the left nipple, a little mesial to the mammary line and 9.5 cm. from the midsternal line. There was no wound of exit. A small roundish mass could be indistinctly felt beneath the skin, 2 cm. to the left of the spinous process of the twelfth dorsal vertebra.

The patient was not in shock, nor did he show signs of severe hæmorrhage. There was tenderness and rigidity over the upper part of the abdomen on the left side.

Operation at eight P.M., three hours after receiving the injury. Under ether anæsthesia the abdomen was opened by an incision 15 cm. long, over the lateral border of the left rectus. There was a moderate amount of blood in the peritoneal cavity. The stomach, which was retracted beneath the ribs, was drawn down, and a perforation was discovered in the anterior surface high up on the fundus. The hole was round, as if punched out. The lesser sac was opened and the posterior surface explored; no wound was found. On more extended examination a second opening was discovered on the anterior surface behind the first perforation. This hole was irregular in shape, and considerably larger than the first. In the manipulations a small amount of the stomach contents escaped. Both perforations were closed with purse-string sutures of silk, and second reinforcing sutures of catgut. The spleen was explored and found uninjured. There was considerable hæmorrhage through the bullet wounds in the diaphragm, apparently coming from the thoracic cavity; and on each respiratory movement air and blood were sucked through these openings. The abdominal cavity was thoroughly irrigated with warm salt solution and the abdominal incision closed without drainage. A second incision was then made over the eighth rib in the axillary line, and one inch of the rib was resected and a tube introduced. Duration of operation, fifty-five minutes.

Immediately after operation, the temperature was 98° F.; pulse, 112; respirations, 32. During the night he vomited several times. The vomitus was copious and dark brown. After this vomiting ceased. He passed flatus by the bowel the following day. The temperature reached 102° F. on the second day, and fell to normal on the fifth day.

For the first twenty-four hours he was given nothing but water by mouth; after that small quantities of milk were administered at intervals. After the fourth day he was given various Chinese soups made largely of rice. During the first four days there was a free bloody discharge from the thoracic tube, the dressing being soaked with blood. There was no respiratory difficulty. Respirations were 24 on the second day. On the third day the patient coughed up a little dark blood. The stitches were

removed from the abdominal wound on the eighth day. Primary union.

After the fifth day the temperature began to rise; on the eighth day it was 104° F. There was free sero-purulent discharge from the thoracic wound. The temperature reached normal again on the twelfth day; the character of the discharge had become distinctly purulent. There was a second rise of temperature on the sixteenth day and it was evident that the chest wound was not draining properly, the diaphragm coming in contact with the end of the drainage tube. Under ether anæsthesia two inches of the sixth rib in the mid-axillary line were removed. Temperature was normal on the twenty-sixth day.

On the seventeenth day the patient complained of pain at the point of lodgment of the bullet in the back. Under cocaine anæsthesia an incision was made over the mass near the twelfth dorsal vertebra, and a cavity was opened containing about 2 drachms of pus, the bullet and particles of clothing.

The patient is now up and about and rapidly gaining strength, eight weeks after the operation.

CASE III.—On January 14, 1907, at 9.30 A.M., a negro, thirty-eight years old, was admitted to the Roosevelt Hospital. He had been shot one hour before. He refused to tell the circumstances of the shooting; but his clothing was scorched as if he had been wounded at short range. He was in slight shock; his temperature was 98° F.; pulse, 104; respirations, 36. The wound of entrance was in the left axillary line over the ninth rib. There was no wound of exit. There were pain, tenderness and rigidity over the upper abdomen. The urine was slightly blood stained.

Operation at 10.30 A.M., two hours after the injury; under ether anæsthesia the abdomen was opened through an incision corresponding to the outer border of the rectus. The peritoneal cavity was filled with blood. An attempt was made to draw the stomach into the wound, but this could not be accomplished on account of adhesions. During the manipulations there was a gush of dark brown fluid. After long search an opening was found in the greater curvature, at the attachment of the gastro-colic omentum, two inches above the point where its direction changes from vertical to horizontal. It was closed with a purse-string suture. The lesser sac was opened through the gastrocolic omentum, and

an attempt was made to explore the posterior surface of the stomach. No opening could be found. No injury to the spleen nor to the neighboring coils of intestine was discovered. The abdominal cavity was irrigated and a cigarette drain introduced down to the stomach wound. The temperature after the operation was 98° F.; pulse, 120; respirations, 36. During the day he grew gradually weaker, his pulse became more rapid, his temperature rose to 104° F. He died at 3.30 A.M., evidently from hæmorrhage, sixteen hours after the operation.

At autopsy dense adhesions were found in the neighborhood of the spleen. There were two perforations in the stomach; one firmly closed by suture in the greater curvature, the second about one inch from it, on the posterior surface. There was a large retroperitoneal hæmorrhage, the bullet having passed through the upper pole of the kidney. It was lodged in the muscles of the back. There were signs of beginning peritonitis.

In all these patients the stomach was perforated, but the gravity of the injury in the second and the third cases depended on the complicating visceral lesions.

It has, therefore, seemed to me of interest to study the injuries which are likely to be associated with gunshot wounds of the stomach and to see if any deductions can be drawn as to the influence of these on mortality, and any guide obtained for treatment.

As pointed out by Forgue and Jeanbrau,⁴ the stomach is so surrounded by other structures that a gunshot wound of that organ alone is almost impossible. They call attention to the fact that lying, as it does, in the hollow of the diaphragm, which separates it from the left pleura and lung, the pericardium and heart, being partly covered by the liver and resting on the pancreas, kidney and suprarenal and spleen, with the transverse colon and coils of the small intestine below it, there is only one small area in front, where, when moderately distended, it comes in contact with the anterior abdominal wall. They show some admirable diagrams taken from Testut's Anatomy, and reproduced by Moynihan in his book on abdominal operations.

They also show by colored plates the surface areas, anteriorly and posteriorly, of gastric vulnerability. The anterior area lies to the left of the median line; its upper limit corresponds to the dome of the diaphragm, which reaches in the mammary line the fifth rib. The lower limit is a line passing through the junction of the ninth and tenth costal cartilages of each side. The posterior area is oval in shape, with the long axis of the oval slightly inclined toward the vertebral column. It reaches from the eighth rib in the left scapular line, to the level of the spinous process of the second lumbar vertebra. Fully two-thirds of this area of vulnerability falls within the limits of the thorax; that is, a bullet, to reach the stomach, must pass through the chest wall and the diaphragm. The stomach being a movable and dilatable organ, and the various structures in contact with it varying in volume from time to time, it is obvious that this area must be constantly changing. It is only true when the stomach is moderately distended.

They emphasize these points in topographical anatomy to show that it is difficult to wound the stomach without injuring surrounding structures, and point out that in a series of one hundred and twenty-six cases of gunshot wound of this organ thirty-two times only was there no associated injury. This proportion would be even less if they had considered wounds of the pleura and diaphragm as complicating injuries.

They find that the mortality varies with the time of intervention and co-existing injuries, and show from their series a mortality of 42 per cent. in uncomplicated cases and of 68 per cent. in cases complicated by other visceral injuries. Their table includes a number of cases reported from fifteen to twenty years ago.

One would expect a lower mortality in gastric perforation without associated injuries, for the chyme is a bad culture medium for pathogenic organisms, and the contents of the fasting stomach, it is said, are relatively sterile.⁵ It would seem that when the operation is performed a few hours after the receipt of the injury most of the patients should recover. Such I believe to be the case in uncomplicated stab wounds of

the stomach. The chief danger in these cases would be hæmorrhage, and to less extent peritoneal infections introduced from without.

In gunshot wounds of the stomach two elements of danger are added. A bullet nearly spent may pass through one wall of the stomach and may bruise the mucosa without again perforating. There may be no evidence of this contusion externally, or there may be an area of ecchymosis. Such bruised areas may cause immediately a fatal hæmorrhage, or, as in Forgue's interesting case, the hæmorrhage may come on later, after the formation of an actual ulcer. His case is a rare example of uncomplicated gunshot wound of the stomach, operated on within one hour of the receipt of the injury and with a fatal outcome. No other structure of importance was injured, neither the diaphragm, the pleura nor any viscus. The bullet (7 mm.) passed through the abdominal wall in the epigastric region. The shot was fired at close range, but at the laparotomy which was performed one hour after the injury only one perforation was found in the anterior wall of the stomach. The perforation was sutured and the abdomen closed. The patient did well for two days. On the third day he vomited blood several times, his pulse became weak and he died with symptoms of internal hæmorrhage. At autopsy the peritoneum was normal and the anterior perforation was found firmly closed. The stomach and small intestine were filled with blood. On the posterior surface of the stomach there was an area of ecchymosis about 5 cm. in diameter. At its centre the mucosa had disappeared and the wall was much thinned. Histological examination showed lesions analogous to those found in beginning ulcer of the stomach. The bullet was found within the stomach.

Such cases must be very unusual. Fertig,⁶ in a recent article on traumatic ulcer of the stomach, does not mention gunshot injuries among the causes of this condition.

In a few other instances the bullet has remained in the stomach and has been subsequently vomited or passed by the bowel. In still other cases the bullet has not actually pene-

trated the stomach cavity, but has torn, in its passage, a hole or gutter in the stomach wall. In most instances, however, there has been a wound of exit as well as a wound of entrance, and the failure to detect, at the time of operation, this second opening constitutes another danger peculiar to bullet wounds of the stomach.

Frisch⁷ has reported a case of this kind, followed by recovery, the X-ray showing the bullet in the muscles of the back, and has collected five similar cases, all of which are included in Forgue's series. He has proved experimentally that the wound of exit made by bullets of small calibre may be an irregular H- or V-shaped tear, and that the rent in the serosa is often difficult to detect even on close inspection.

M. Auvray,⁸ who has operated on seven patients with perforation of the stomach, in describing three recent cases before the 19th Congress of the French Surgical Association, October, 1906, emphasized especially this difficulty. He advised a large opening in the gastrocolic omentum, and, as it was often insufficient, considered the indications for exploratory gastrotomy.

The failure, however, to suture the bullet hole in the posterior wall of the stomach has not materially influenced the mortality. Still, in two instances, it was followed by a subphrenic abscess, and although the patients recovered, convalescence was much delayed, and there are two instances in Forgue's series where failure to close a second opening on the anterior surface was followed by peritonitis and death.

In a series of twenty-five cases reported since 1903, there is no instance in which this accident caused death. Auvray's, Frisch's, Kroner's, Zawadzki's and Jordan's patients all recovered, and in the other instances death resulted within a few hours from hæmorrhage due to associated visceral injuries.

However fortunate one may be in escaping the consequences, an operation cannot be considered satisfactory which leaves unsutured a gastric perforation. A simple method of testing the integrity of the posterior stomach wall might be carried out in the following manner. As soon as the bullet

wound is found in the anterior wall, a purse-string suture of silk is passed about it in the usual way. A rubber tube is then introduced into the perforation, the suture tightened firmly about the tube, and a single knot tied and held by a clamp. If a hole be torn through the gastrocolic omentum, and salt solution introduced through the tube into the stomach, one should be able to appreciate readily whether the solution is escaping into the lesser cavity. If such prove to be the case, then the opening in the omentum may be enlarged by dividing, widely if necessary, the gastrocolic omentum, as suggested by Forgue. If there be no escape it is reasonable to suppose that there is no opening or an opening too small to be likely to cause a dangerous leakage. The tube can then be withdrawn from the anterior opening, the purse string drawn together and tied, and the reinforcing sutures introduced.

This method would have the obvious disadvantage that the stomach contents, should there be a perforation, might be forced into the lesser sac, still further contaminating it. But the advantage of being able to tell with certainty whether there is a second perforation seems to me to outweigh this objection.

Of these two dangers peculiar to bullet wounds of the stomach, the first, hæmorrhage from erosion of the mucosa from a spent bullet, rarely occurs; and the second, the difficulty in finding the wound of exit, seems to be only to a small extent responsible for the fatality of the injury.

The records of cases published fifteen or twenty years ago, in which no operations were performed, show clearly that associated visceral injuries were in most instances the cause of death. As has been previously stated, one would expect on anatomical grounds a gunshot wound of the stomach to be almost always accompanied by injuries to adjacent structures, and if one considers wounds of the diaphragm, lung and pleura as complicating injuries, then an isolated injury of the stomach is very uncommon. In examining the cause of death in thirteen cases tabulated by Forgue as treated expectantly and as being without complicating visceral lesions, in one

instance death occurred within a few hours from hæmorrhage, the sixth interspace close to the sternum border having been perforated. There is no note as to whether the hæmorrhage was thoracic or abdominal. In a second case, death occurred at the end of several days; in the autopsy notes it is stated that there was neither hæmorrhage nor peritonitis. In a third, in which the wound was caused by a bullet from a revolver, 7 mm., at close range, the wound of entrance being in the seventh interspace, death occurred in two days. The autopsy showed the left lung retracted and the pleural cavity half full of a putrid, watery material mixed with particles of food. The bullet had perforated the pleura, the diaphragm, the stomach in three places, again the diaphragm, and was found lodged in the body of the eleventh dorsal vertebra. The spleen, heart and pericardium were uninjured. There was no peritonitis. In two instances, death occurred from peritonitis; in another, death occurring four months after the injury, the stomach wound was found firmly cicatrized. So, in this series reported as without complications, in only two cases was the fatal outcome due to gastric injury.

A perusal of the cases reported in the second series, in which are grouped cases with complicating visceral injury, shows that in nearly every instance death was due to the associated injury. In several, in which the patient had lived for a number of days, the wound in the stomach had healed, in one instance death being due to an abscess in the liver. In a second case, reported by Rostowzew,⁹ the wound of entrance was in the seventh interspace, between the parasternal and mammary lines. There were no abdominal symptoms. On the fourth day it was necessary to aspirate the chest on account of symptoms of asphyxia; on the sixth day foul-smelling bloody fluid was escaping from the bullet wound; on the eighth day the patient died. The post-mortem examination showed two healed wounds in the stomach and a small blood clot and fibrinous exudate on the neighboring serosa. The bullet had passed through the diaphragm, the stomach, and the lower lobe

of the left lung. Death was due to the thoracic complications, not to the injury to the stomach.

In another instance there were wounds of the kidney, the pancreas and the inferior vena cava. Death had occurred in a quarter of an hour.

A further study of gunshot wounds over the area of gastric vulnerability includes, therefore, an inquiry into the associated visceral injuries. As pointed out above, the greater part of this area lies within the limits of the thorax; therefore in the majority of cases there will be a wound of the thoracic wall and diaphragm; in many cases, of the pleura and lower lobe of the left lung.

Such wounds may cause hæmorrhage in the thoracic cavity, and are usually treated by careful cleansing of the surrounding skin, an occlusive dressing applied to the wound and complete rest. The resulting hæmothorax is treated by aspiration as soon as signs of dangerous compression appear. Such hæmorrhage into the chest may come from the thoracic wall, one of the intercostal arteries being divided, or from the lung itself. When it is from the lung, it is believed that the blood collecting in the rigid thorax helps to check the hæmorrhage by exerting pressure on the pulmonary tissue, and one is cautioned not to aspirate until the wound in the lung is closed, lest the hæmorrhage should again be started.¹⁰ It is also generally assumed that the collapsed lung bleeds less than the expanded lung, or that in a given time less blood actually flows through it than normally, and it has even been suggested that the chest should be widely opened, with the idea of checking the hæmorrhage by causing the collapse of the lung. Sauerbruch,¹¹ however, has proved experimentally that in unilateral pneumothorax more blood flows through the collapsed lung than through the same lung before the pneumothorax was established. He finds that there is a hyperæmia of the collapsed lung.

In whatever manner one may interpret the complex phenomena found in the alteration of normal pulmonary conditions, the production of a pneumothorax does not come into

consideration in the class of injuries under discussion. As soon as the abdomen is opened for the purpose of suturing the stomach, air is sucked through the bullet holes in the diaphragm and the lung collapses, if it has not already done so, and a pneumothorax is established.

In a series of experiments, Noetzel¹² has shown that the pleura under physiological conditions is very resistant to infection. If, however, important physiological relations are altered by the entrance of air into the pleural cavity, then the resistance is greatly reduced. The introduction of infectious material into the pleura, when a pneumothorax was established, was invariably followed by an extensive empyema.

If there be any escape of stomach contents during the manipulations of an operation or if there has been any beforehand, particles may readily be drawn through the wounds of the diaphragm into the thorax, and another element may be added to a hæmopneumothorax. It has been previously stated that the chyme is relatively free from pathogenic microorganisms, and the infection which has been shown to follow in some cases may have been introduced into the pleura by particles of clothing or other material carried in by the bullet, the foreign matter from the stomach simply adding to the conditions favorable to bacterial life.

It would seem, therefore, that in certain cases with a well established hæmopneumothorax, drainage of the chest was desirable.

It might with justice be urged that, after suture of the diaphragmatic wound and closure of the abdomen, the pneumothorax would speedily disappear and that it would be legitimate to wait to see whether a severe infection of the thorax would follow. However, conclusions drawn from thoracic injuries uncomplicated by a wound of the diaphragm are, I believe, misleading, and in the second case reported, when I opened subsequently an abscess in the back containing the bullet and particles of clothing, I was satisfied, in this instance at least, that drainage of the thorax was desirable, and it seemed to me that the resulting empyæma was less extensive and the conva-

lescence shorter than if the thoracic condition had been treated expectantly.

Much attention has been devoted in recent years to wounds of the diaphragm, to their treatment, and to the possibility of diaphragmatic hernia.^{13 14} The impetus to this study has been furnished largely by Italian surgeons, who have unusual opportunities for studying and treating stab wounds, and the majority of cases reported have been stab wounds, not gunshot wounds. Among seventy-three cases reported by Suter,¹⁵ five only were gunshot wounds, and of these, one was caused by a charge of shot; in a second case a fractured rib tore the diaphragm; in a third the weapon was a rifle and the injury was inflicted apparently at close range; and in a fourth the ensiform cartilage was hit, tearing the insertions of the diaphragm.

It is evident that gunshot wounds of the diaphragm heal, for diaphragmatic hernia is very uncommon notwithstanding the number of thoracic injuries received in battle. It is also obvious that an incised wound, if it pass through diaphragm at right angle to the course of its fibres, would gape more than a bullet wound and would be much more likely to be followed by diaphragmatic hernia. In the only instance of such injury that I have seen, a large piece of omentum was protruding through the chest.

An observation by F. König¹⁶ shows the manner of healing in gunshot wounds. In this instance the wound of entrance was in the fifth interspace near the mammary line, the wound of exit about an inch to the left of the tenth dorsal vertebra. The abdomen was not open. The chest was aspirated several times. The patient died on the forty-fourth day. The autopsy showed that the pericardium, which had been grazed by the bullet, was adherent to the heart and firmly bound by dense adhesions to the diaphragm. The bullet had passed through the liver and grazed the stomach, causing a traumatic ulcer. There were multiple hepatic abscesses. It passed again through the diaphragm, tearing irregularly the muscle fibres, and finally through the pleura and lung. The pleural surfaces over the

bullet opening in the diaphragm were firmly united by dense adhesions completely sealing the opening.

There are, however, a few cases reported of hernia following gunshot wounds. Bardenheuer,¹⁷ in 1879, gave the details of an autopsy on a man who had been shot eight years before, and whose death had been caused by a strangulated diaphragmatic hernia through the old bullet wound. Robert¹⁸ reports the case of a man shot in the sixth interspace by a revolver bullet of 7 mm. He recovered. One year later death occurred from an intestinal obstruction. The autopsy showed a hernia through the diaphragm.

There is, therefore, a real danger from bullet wounds of the diaphragm, and such wounds, if accessible, should be sutured.

Injury to the liver has been the most frequent visceral complication, and the wound has usually been of the left lobe. The hæmorrhage has not, as a rule, been profuse; only one fatality can be attributed to it. In a number of cases the liver wound was closed by suture; in two, hæmorrhage was checked by packing; in another, the bullet passed through the gall-bladder, which was excised.

The spleen has been injured a number of times. In a recent article on traumatic lesions of this organ, Noetzel¹⁹ has emphasized the necessity of the removal of the spleen wherever the organ is much damaged, calling attention to the fact that sutures do not hold in the friable splenic substance. This difficulty in suturing the spleen is mentioned in a case reported in Forgue's series. The splenic wound was finally packed and the patient recovered. In another instance the wound in the spleen was unrecognized at the operation undertaken for the gastric perforation. Death resulted on the seventh day. At autopsy a wound was found in the upper pole of the spleen. There was a perforation of the diaphragm and a litre of blood in the left pleural cavity, as well as a wound of the lower lobe of the left lung. In a third case the splenic wound was cauterized, the patient dying in a few hours. In a fourth case the spleen was removed; death occurred two days later. The

spleen was injured in four of the cases in the series I have tabulated. In two, the spleen was removed; in a third a Mikulicz tampon was introduced; in the fourth the injury was slight. All recovered.

The pancreas is reported as injured in eight instances in Forgue's series of eighty-one cases in which an operation had been performed and perforation of the stomach found. In seven instances the patient died. In all these there were other severe complicating lesions. One patient recovered. In this case the wound in the pancreas was packed and drainage introduced. There was an escape of pancreatic juice for several days. Death occurred in most of the fatal cases within twenty-four hours, apparently from hæmorrhage; in one instance not until the eighth day. In this case, at autopsy the entire bullet track, and the pancreas itself, were found gangrenous. There had been but little attempt at repair.

Borchardt ²⁰ has collected fifteen cases of gunshot wounds of the pancreas. Six were taken from the older records, at a time when penetrating abdominal wounds were not operated on, and in every instance death resulted. Of the nine cases operated on, the stomach was perforated in three; they appear in the series already discussed. Suture of the pancreatic wound and the introduction of drainage is the treatment recommended. There were five recoveries and four deaths in this series of cases.

Becker, ²¹ in reporting an unusual case of isolated gunshot wound of the pancreas, calls especial attention to the introduction of drainage in these cases as a means of avoiding the peculiar fatty or pancreatic necrosis. In his case the bullet grazed the stomach without perforating it, and no other viscus was injured. The patient recovered.

The records show that in eight instances the bullet, after passing through the stomach, wounded the upper pole of the kidney, causing usually a large retroperitoneal hæmorrhage. Six of the patients injured in this way died; two recovered. In one case two perforations of the stomach and one of the transverse colon were closed with sutures, and a large retro-

peritoneal hæmatoma were noted; but apparently no treatment directed toward the kidney was carried out. There was hæmaturia for several days following the operation. The patient recovered. In two instances the kidney was removed, and in both the outcome was fatal. In Riese's case reported in my series, the twelfth rib was resected and the wound in the kidney packed. The patient recovered. In several instances the wound of the kidney and the retroperitoneal hæmorrhage were only made evident at autopsy.

Perforations of the small intestine and transverse colon are recorded among the complicating visceral injuries in sixteen cases. In one instance there were eleven perforations of the small intestine and two of the colon. In several there was a single perforation. Eight of the patients recovered. In most of the instances with a fatal outcome, there were a number of holes in the intestine.

From this inquiry into the associated lesions of gunshot wound of the stomach, the conclusion may fairly be drawn that the complicating lesions are in most instances of graver importance than the gastric injury, and that to speak of the high mortality of gunshot wounds of the stomach is misleading. In any gunshot wound, it is the sum of the injuries inflicted on the different organs and structures which is responsible for the gravity of the condition.

To-day, when it is the rule to operate immediately, there is little opportunity of making an accurate diagnosis of the organs injured; one cannot wait for vomiting of blood, or even for the onset of rigidity in the abdomen. The situation of the small perforating wound furnishes the only guide. If this is over the area of gastric vulnerability extending on the left side from the level of the fifth rib in the mammary line to a line passing through the extremities of the tenth rib, anteriorly; and from the eighth rib in the scapular line to the level of the spinous process of the second lumbar vertebra, posteriorly, then one may expect a number of important organs and structures to be wounded; and it seems to me of practical advantage to think of the injuries recorded in similar cases.

It is obvious that a shot may enter the body at any angle, and without a wound of exit, and in the absence of an accurate history one may be unable to determine the course of the bullet. Fortunately, the bullet is often to be felt in the subcutaneous tissue, the force of a bullet from a revolver (.32 or .38 calibre), the weapon most frequently used, being sufficient to drive the bullet through the body as far as the tough and elastic skin of the other side. In any event, doubt as to intervention would only arise when the entrance wound was near the upper limit of this region.

In an operation undertaken for a wound in this area it is necessary to think of all the structures likely to be injured and to be prepared not only to suture a wound in the stomach, but to treat any of the associated injuries. And a reduction in the fatalities should go hand in hand with the recognition and treatment of these complicating lesions. In the twenty-five cases which I have tabulated this is clearly shown. In most of them there were associated injuries of graver significance than the stomach injury; in two, splenectomy was performed; in two, thoracotomy as well as laparotomy; in five, the diaphragm was sutured; in one, the twelfth rib was removed and a wound in the kidney packed; in another the gall-bladder was excised. There were six deaths and nineteen recoveries, or a mortality of less than 25 per cent. Most of the cases were operated on within a few hours of the receipt of the injury, the longest interval being eighteen hours. In this instance the patient recovered.

This mortality represents, not deaths occurring from gunshot wounds of the stomach, but those resulting from injuries inflicted by bullets passing through the area of gastric vulnerability.

It would be interesting to contrast these injuries with gunshot wounds over the area of hepatic vulnerability.

It might be urged that only favorable cases are published. These cases, however, have been taken, in most instances, from records of all penetrating gunshot wounds reported in a given period from the hospital services of various surgeons.

ABSTRACT OF REPORTED CASES OF GUNSHOT WOUNDS OF THE STOMACH SUBJECTED TO OPERATION.

Number.	Reference.	Age, Sex, Nationality	Weapon, Distance.	Interval between Injury and Operation	Wound of Entrance; Wound of Exit.	Operation.	Injury to Stomach.	Associated Injuries.	Result.
1	M. Anvray. Assoc. Franç. de Chir., XVI Congrès, 03, p. 341.	31; M.	Revolver; 4 or 5 metres.	2 hrs.	Left costal border, probably the sixth interspace. No exit wound.	Median laparotomy.	In greater curvature, 3 cm. above point where greater curvature passes from vertical to horizontal. Suture. No wound of exit.	Diaphragm.	Recovery.
2	K. Borszékéy. Beitrage z. klin. Chir., B. xlviii, p. 577, 1906.	15.	Two paces.	18 hrs.	Two fingers breadth above navel, to the right of linea alba. No exit wound.	Median laparotomy.	In middle of lower border of stomach. Sutured. Second hole on posterior surface not far from cardia. Sutured.	Bullet found in hilus of spleen. Mikulicz tampon applied to hilus. Removed on tenth day.	Recovery.
3	O. Brehm. Arch. f. klin. Chir., B. lxxiii, p. 234, 1904. Case XVI.	20; F.	Revolver.	2 hrs.	Left hypochond. No exit wound.	Median laparotomy.	In greater curvature. Suture. No wound of exit discovered.	Gutter in left lobe of liver, 2 cm. long. Sutured.	Recovery.
4	Idem. Case XVII.	26; F.	Revolver.	2½ hrs.	Eighth left intercostal space in mammary line. No exit wound.	Median and transverse laparotomy.	Perforation anterior surface. Suture. Perforation posterior surface. Suture.	Gutter in left lobe of liver, and in spleen. Severe hemorrhage from splenic artery. Ligated; spleen removed; tampon. Subphrenic abscess.	Recovery.
5	J. V. Brown. St. Louis Courier of Med., v. xxxiii p. 9, 1905. Case I.	30; M. Italian.	Revolver; close range.	1 hr.	Below left costal border. Exit wound between ninth and tenth rib on right side.	Median laparotomy.	Two openings near pylorus. Closed by suture.	Right lobe of liver near lower border penetrated; packed with gauze. Gall-bladder perforated. Cholecystectomy.	Recovery.
6	E. D. Fenner. ANNALS OF SURG., v. xxxv, p. 15, 1902. Case VI.	27; M. negro.	Not stated.	Not stated.	Tenth rib in left axillary line. No exit wound.	Median laparotomy.	"Good-sized hole in cardiac extremity." Suture.	Laceration of under surface of left lobe of liver. Sutured. Large hole in spleen. Splenectomy. Hole in diaphragm. Sutured. Bullet found in folds of the gastrocolic omentum.	Recovery.
7	O. V. Frisch. Arch. f. klin. Chir., v. lxxiii, p. 656, 1904.	25; F.	Revolver; 7 mm.; three paces.	3½ hrs.	Left mammary line, 2 fingers' breadth below border of rib. No exit wound.	Median laparotomy.	Small opening in anterior surface between cardia and pylorus, and nearer lesser than greater curvature. Suture. Careful search failed to find second opening.	Left lobe of liver perforated by bullet. X-ray subsequently showed bullet in lumbar region.	Recovery.

8	Robert W. Johnson. N. Y. Med. Journal, v. lxxix, p. 586, 1904.	18; mulatto.	Revolver; 32 calibre.	1 hr.	Near median line in epigastrium. No exit wound.	Laparotomy.	Wound in greater curvature, 5 cm. in length. Sutured.	Bullet passed through liver. Wound closed with sutures.	Recovery.
9	W. M. Jordan. American Med., v. ix, p. 1024, 1905.	21; white.	Revolver; 38 calibre.	2 hrs.	Between ensiform and navel. No exit wound.	Laparotomy through bullet wound.	Perforation near lesser curvature. No wound of exit found.	Bullet passed through liver.	Recovery.
10	Idem.	Negro.	Not stated.	8 hrs.	Left linea semilunaris, near costal margin.	Laparotomy, left lateral.	Two perforations on anterior surface. Suture.	.....	Death 4 hrs. after operation.
11	M. Kroner. Arch. f. klin. Chir., v. lxxv, p. 643, 1905. Case XII.	38.	Revolver; 7 mm.; close range.	2 hrs.	Seventh interspace, 1 cm. ext. to mammary line. No exit wound.	Laparotomy, left lateral.	At fundus large perforation. Suture. No other opening found.	Subphrenic abscess, followed by empyema.	Recovery.
12	Idem. Case XIII.	19.	Pistol; 1½ ft.	2 hrs.	Below sixth rib to left of mid-line.	Laparotomy.	Anterior hole near cardia, posterior hole in similar position. Suture.	Wound of liver. Sutured. Subphrenic abscess.	Recovery.
13	Idem. Case XVIII.	35.	Revolver; close range.	13 hrs.	Sixth interspace ext. to mammary line. Exit wound 3 fingers' breadth below angle of scapula.	Laparotomy.	Hole near lesser curvature. Sutured. No other opening found.	Wound of liver. Sutured. Death following day. Autopsy showed second perforation of stomach. No peritonitis. Also, perforation of pericardium and spleen.	Death.
14	W. Martin. Case II.	23; M. Chinese	Revolver; 32 calibre; five yards.	3 hrs.	Mesial to mammary line. Sixth interspace. No wound of exit.	Laparotomy, lateral.	Two holes in anterior surface. Closed by suture.	Wound of lung. Blood in pleura, thoracotomy and drainage.	Recovery.
15	Idem. Case III.	38; negro.	Revolver; 38 calibre; close range.	2 hrs.	Left axillary line over eighth rib. No exit wound.	Laparotomy, lateral.	Hole in greater curvature. Sutured. No other perforation discovered.	Left kidney. Death sixteen hours after operation, from retroperitoneal hemorrhage. At autopsy second opening found in stomach.	Death.
16	Riese, XX XIII. Verhandlungen der Deutschen Gesellschaft f. Chir., v. xxxiii, p. 89, 1904.	20; F.	Revolver; 7 mm.	3 hrs.	Left costal margin parasternal line. Bullet felt under skin in scapula line between eleventh and twelfth ribs.	Median laparotomy, and over twelfth rib in lumbar region.	Entrance wound near cardia. Long search for exit wound. Both sutured.	Left lobe of liver. Wound sutured. Diaphragm sutured. Subperiosteal resection of twelfth rib. Wound in kidney 5 cm. long; packed. Wound of spleen, slight.	Recovery.
17	E. C. Riebel. Surg. Gynecology and Obstet., vol. iv, p. 202, 1907. Case VII.	Negro.	Revolver; close range.	Not stated.	Sixth interspace, midway between mam. and axillary line.	Median laparotomy.	Two perforations in fundus, anterior and posterior, a little above level of cardia. Suture.	Diaphragm wounded, unsuccessful attempt to suture. Death in twelve hours from hemorrhage. Autopsy showed bullet in right lobe of liver. Some hemorrhage in left pleura.	Death.

ABSTRACT OF REPORTED CASES OF GUNSHOT WOUNDS OF THE STOMACH.—Continued.

Number.	Reference.	Age, Sex, Nationality	Weapon, Distance.	Interval between Injury and Operation	Wound of Entrance; Wound of Exit.	Operation.	Injury to Stomach.	Associated Injuries.	Result.
18	Idem. Case XI.	German.	Revolver; 32 calibre.	Not stated.	Two shots. Upper entrance, wound level sixth rib, 2 inches left of spine; lower exit, wound over tenth rib.	Lateral laparotomy.	Two perforations in fundus, opposite cardia. Bullet found in peritoneal cavity. Suture of perforations.	No other abdominal injury.	Recovery.
19	Idem. Case XV.	Negro.	Revolver; close range.	Not stated.	"Centre of sternum on level with sixth costal cartilage."	Median laparotomy.	Two perforations, anterior and posterior. Sutured.	Liver.	Recovery.
20	Idem. Case XVI.	Negro.	Revolver; 22 calibre.	Not stated.	Two inches to left of median line and two inches above navel.	Laparotomy.	Anterior perforation. Sutured.	No other injury.	Recovery.
21	Savariaud. Bull. de la Société de Chir. de Paris, v. xxxi, p. 845, 1905.		Revolver; 9 mm.	3 hrs.	Between ensiform and left costal margin. No exit wound.	Median laparotomy.	Two perforations in anterior wall, near fundus. None in posterior wall. Suture.	Wound of left lobe of liver.	Recovery.
22	Idem. XIX Congrès de Chir. Paris, 1906, p. 155.	Negress; 16.	Revolver; close range.	5 hrs.	Left costal border 5 fingers' breadth from median line.	Median laparotomy and transverse through costal border.	Perforation in ant. wall near greater curvature. Perforation in post. surface reached with difficulty. Both sutured.	.....	Recovery.
23	G. T. Vaughan, Americ. Journal of Med. Science, v. cxxvi, p. 285, 1906.	35; negro.	Not stated.	8 hrs.	One inch to right and slightly above ensiform. No exit wound.	Laparotomy through right rectus.	Two perforations near pylorus. Sutured.	Wound of left lobe of liver and large intestine. Died on operating table, evidently of hemorrhage.	Death. Recovery.
24	A. Ziwadski. Kronik. Iekarsky. 1902, Nr. 16. Ref. Centralbl. f. Chir., 1903, p. 296.	14.	Flobert rifle; close range.	2 hrs.	Ten cm. above navel, left of median line.	Laparotomy through bullet wound.	Perforation in anterior wall. Suture. None in posterior found.		
25	Idem.	Soldier.	Modern rifle; close range.	4 hrs.	Near mammary line, close to seventh rib, 3 cm. long. Stomach contents escaping from wound.	Left thoracotomy. Median laparotomy.	Wound 4 cm. long in stomach. Sutured.	Diaphragm sutured through thoracotomy opening, wound 5 cm.	Death.

In conclusion :

1. Perforations of the stomach alone should show a low mortality.

2. Uncomplicated gunshot wounds of the stomach are very uncommon.

3. The associated injuries are usually of graver significance than the gastric injury.

4. It is misleading to speak of the mortality following gunshot wounds of the stomach without considering the complicating injuries.

5. The mortality of gunshot wounds over the area of gastric vulnerability has been much reduced during the last five years, being now about 25 per cent.

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DUODENAL FISTULA: ITS TREATMENT BY GASTROJEJUNOSTOMY AND PYLORIC OCCLUSION.*

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A DUODENAL fistula, unless it is of pin-hole size, usually occasions a very rapid death from starvation. The duration of life after the establishment of such a fistula depends upon the size of the opening into the duodenum and upon the readiness with which the duodenal contents are discharged. The writer has lost a patient from a duodenal fistula subsequent to a perforating ulcer, in three days, and no doubt others have had similar experiences.

Numerous mechanical devices have been suggested for the relief of this condition, but all have proved insufficient. The proposal of Elliot (*ANNALS OF SURGERY*, 1905) to overcome the malnutrition resulting from the loss of undigested discharges from high-seated intestinal fistulæ, by collecting the discharge from the loop afferent to the fistula and injecting it into the loop efferent to it, is scarcely applicable to duodenal fistulæ, because the duodenum cannot be brought up to the anterior abdominal wall so as to enable us to readily collect the discharges from it and reinject them.

With the view of preventing the rapid deterioration of patients afflicted with duodenal fistulæ the writer proposed (*Central. fur Chirurgie*, 1903, page 556) that a gastro-enterostomy be established and the pylorus occluded. The proposition made at that time had not been tested in actual practice, but since then he has twice had occasion to carry it out, and wishes now to report on its efficiency in overcoming this other-

* Read before the Surgical Section of the New York Academy of Medicine, January 4, 1907.

wise fatal lesion, and to suggest some points of practical importance in the technique of its performance.

The first case in which the writer carried out his proposal was a patient in whom a cholecystoduodenostomy had been done by Dr. Gerster for the relief of obstructive jaundice due to compression of the common bile duct by a pancreatic enlargement, possibly of an inflammatory character. The anastomosis between the distended gall-bladder and the anterior surface of the second part of the duodenum had been made with Murphy's button, re-enforced with a few sero-muscular sutures. The patient did well for five days, and the jaundice diminished. On the fifth day there was a profuse discharge of whitish acid material from the opening in the abdominal wall that had been left for drainage, and on examination it was found that this discharge came from the duodenum, alongside of the button. The duodenal wall at this site was necrotic, permitting the button to protrude through it. Within the following twenty-four hours the leakage of duodenal contents was very profuse, and coincidentally therewith the general condition of the patient deteriorated very markedly. An attempt was first made to close the opening in the duodenum by suture after removing the necrotic tissues; the gall-bladder being drained externally by tube. This suture, however, did not hold, owing to the infected condition of the parts, and four days after this operation there was again a profuse leakage of duodenal contents. During these four days the patient's condition improved somewhat, but with the re-establishment of the leakage it rapidly deteriorated again.

I determined, therefore, even though the patient was in a most desperate state, to do a gastrojejunostomy and tie off the pylorus, hoping thereby to sidetrack the chyme into the jejunum and thus enable the patient's nutrition to go on uninterruptedly. An anterior gastro-enterostomy was accordingly very rapidly done with Murphy's button through an incision along the outer border of the left rectus muscle, while through the original wound, in which the pyloric end of the stomach was lying exposed, a large-sized silk ligature was passed around the pylorus and only drawn tightly enough to approximate the mucous walls of this orifice to one another. The incision at the outer border of the left rectus was closed without drainage, and the primary wound loosely

packed with gauze. The patient bore this operation very nicely. The discharge of chyme from the duodenal fistula ceased at once, and coincidentally therewith the general condition improved. Eleven days after this last operation it was noticed that the suture which had been placed around the pylorus was cutting through. It was uncertain whether this was due to the ligature having been applied too tightly, in spite of my care to avoid this, or whether, because of the poorly nourished condition of the parts, the mere pressure of the silk ligature was sufficient to cause it to cut through them. To avoid further trouble from this ligature, it was loosened and the adjacent walls of the stomach and duodenum inverted over it by two tiers of sero-muscular sutures. (The importance of applying the pyloric suture with just sufficient tightness to approximate its walls will be alluded to again.)

From the time of the gastro-enterostomy and pyloric occlusion there was never any discharge of chyme from the duodenal fistula. For the first ten days thereafter the patient's condition improved markedly, but then it gradually failed and he died of exhaustion seventeen days after the last operation. Autopsy showed the enlargement of the pancreas to be cancerous in character; the gastrojejunal orifice was a wide one, and the pyloric opening was effectively occluded by the ligature which surrounded it. The walls of the pylorus were commencing to be cut through by the latter ligature.

It was plain that in this patient the impending death from duodenal leakage was averted by the gastrojejunostomy and pyloric occlusion. The ultimate fatal issue was not due to the complicating duodenal leakage but to cancerous cachexia. In my subsequent review of the details of this case, two points came up for consideration.

(a) Is it necessary in order to divert the chyme from the duodenum into the jejunum to occlude the pylorus, or is it sufficient to simply make a gastrojejunostomy? (b) If it is essential to occlude the pylorus then great care must be exercised in applying the occluding ligature lest it cut through the tissues; for in the case just narrated the ligature, though tied only tightly enough to approximate the pyloric walls, nevertheless showed a tendency to cut through these tissues. It is evident that if

this ligature does cut through the pylorus a gastric fistula would result, which in turn would likely prove fatal to the patient.

As regards the first point, viz., is it necessary to occlude the pylorus in addition to making a gastrojejunostomy when we wish to divert the chyme directly into the jejunum?

It is commonly believed that if a gastrojejunal fistula is established at the lowest point of the stomach the contents of the latter viscus will be emptied directly into the jejunum through this anastomotic opening, even when the pyloric opening of the stomach is patent. This is, however, an erroneous belief, as is shown by the experiments of Kelling and as is demonstrated by the observations recorded in a second patient of mine with duodenal fistula. In this latter patient I contented myself with making a gastrojejunostomy, which, however, did not suffice to divert the chyme into the jejunum.

Kelling (*Langen. Archiv fur klin. Chirurgie*, vol. lxx, page 289) established in healthy dogs with normal pylorus an anterior gastrojejunostomy.

Then he made fistulous openings in the duodenum and jejunum respectively, 12 cm. below the pylorus in the former, and a like distance below the gastrojejunal orifice in the latter, In each of these he placed a tube that could be effectually closed by a cork. Three days after this operation he filled the stomach with 250 c.cm. of water tinged with methylene blue or rubin red. Thirty minutes thereafter he recovered 100 c.cm. from the duodenal fistula and only 5 c.cm. from the jejunal fistula; 40 minutes thereafter 135 c.cm. had been recovered from the duodenal fistula and only 6½ c.cm. from the jejunal. After another 15 minutes 6 c.cm. more from the duodenal fistula and only 3½ c.cm. from the jejunal. From a number of experiments of a similar character as the above, but slightly modified in their details, he concludes that in dogs with normal stomach, in which a gastrojejunostomy has been established, the passage for the stomach contents through the pylorus is at least as easy as it is through the gastrojejunal opening. That a similar state of affairs exists in the human subject is demonstrated by the clinical observations of the writer in a case of

duodenal fistula resulting from a ruptured duodenal ulcer. In this patient a gastrojejunostomy was done but the pylorus was left unoccluded.

Chas. A. W., a native of England, fifty-two years old, and a mechanic by occupation, was seen by the writer with Dr. Matthews on February 11, 1906. For two years prior to the present illness he had suffered with attacks of vomiting, not associated with the taking of food. On February 1, 1906, the patient was suddenly seized, while at work, with severe abdominal cramps which subsequently localized themselves to the right iliac fossa. He vomited at the onset, but had no fever or chills. His bowels were constipated. With rest in bed and local applications of ice, he improved, and three days later got up. Twenty-four hours before I saw him, while he was sitting by the stove, he was again suddenly seized, after a severe sneezing spell, with acute abdominal pain and vomiting. The pain was most severe just below the free border of ribs on left side. On physical examination, the heart and lungs were normal. The abdominal wall was of board-like rigidity and did not move with respiration. The liver dulness was replaced by dull tympanitic resonance. There was dulness in both flanks, which did not, however, shift with change in the patient's position. There was an area of dulness in the right hypochondrium which corresponded to an ill-defined mass about the size of a teacup saucer. His temperature was 100, his pulse 108. Diagnosis: Ruptured duodenal ulcer, with encapsulated periduodenal exudate. Immediate laparotomy was proceeded with at Mt. Sinai Hospital. An incision was made over the mass through the right rectus muscle. Immediately on incising the peritoneum, fresh adhesions were encountered to the right of the suspensory ligament of the liver and extending downward to the umbilical region. The adhesions were carefully separated and the peritoneal surfaces thus exposed at once protected by gauze packings. On separating the adhesions toward the liver a large, foul smelling gaseous abscess containing about a pint of creamy pus was entered into and evacuated. After the pus was removed a perforation was found on the anterior surface of the first part of the duodenum about the size of a pea, with gangrenous edges; the surrounding peritoneal surfaces of the stomach and duodenum were covered with necrotic fibrin and pus. After this

latter was carefully removed, the perforation was closed with three layers of Lembert sutures placed in the vertical axis of the duodenum. The abscess cavity was drained and the abdominal wound closed with layer suture down to the emergence of the drains. The patient reacted well from the operation. The highest temperature and pulse for the following week were 100.6 and 104 respectively.

No drink or food were allowed by mouth for five days, rectal nourishment and saline subcutaneous infusion being used to replace them. On February 18, *i.e.*, seven days after the operation, there was noticed for the first time an escape of gastric contents and bile from the drainage openings. Recognizing at once the fact that we had to deal with a duodenal fistula that, on account of the changed character of its surrounding peritoneal surfaces, could not be closed by suture, and profiting by the sad experiences gained in previous cases of duodenal fistula, in which death from inanition and exhaustion followed after 48-72 hours, I at once proceeded to carry out the suggestion I had made in 1903, *viz.*,^{*} gastrojejunostomy with pyloric exclusion. A posterior gastrojejunostomy without a loop by the suture method was accordingly made, but instead of occluding the pylorus, I sewed up again the opening in the duodenum, hoping thereby to avoid all danger from a possible cutting through of the occluding pyloric suture.

The patient bore this operation well, and for two days there was no escape of gastric or duodenal contents. Then the suture line in the duodenum again gave way and there was a renewal of the leakage. It was noticed that after the patient took some milk by mouth there would be, within ten minutes, a discharge of milk from the duodenal fistula, and within fifteen to twenty minutes more, approximately all the milk that had been ingested had escaped from the duodenal opening. The wound in which the fistulous opening lay was so infected that I now hesitated, from fear of infecting the peritoneal cavity, to expose the pylorus sufficiently through it, in order to enable me to pass an occluding ligature around it. I therefore made several further attempts to close the duodenal opening by suture, but each time after twenty-four hours the sutures would cut out and leave the opening as before; and each time the duodenum was open, whatever was taken into the stomach would practically all be discharged through

it within fifteen to thirty minutes after it was ingested. On February 28, *i.e.*, ten days after the gastrojejunostomy, I was compelled by the progressive deterioration of the patient to brave the danger of a peritonitis, and to mobilize the pylorus and surround it by an occluding ligature, using for the latter a broad piece of tape. This was passed around the pylorus snugly enough to effect approximation of its walls, but with no constriction of the parts, and held in place by a silk ligature, the knot of which rested on the tape and not on the pylorus itself, thereby avoiding pressure from it upon the pylorus.

Immediately after this operation the patient was given 6 ounces of milk and water. There was no leakage, nor was there any further leakage from the fistula during the next twenty-four hours. The patient's strength, however, was so much exhausted by the intermittent but continued discharge of chyme and duodenal contents that he did not rally from this last operation and succumbed the next day.

Post-mortem examination revealed a gastrojejunal orifice patent for 3 fingers, and a ruptured duodenal ulcer.

Here there is a clinical demonstration in the human subject of a widely patent gastrojejunal fistula failing to divert the gastric contents when the pylorus was patent and thus failing to relieve the death from inanition that follows upon a persistent duodenal fistula. Kelling's experiments in dogs and our own clinical observations, thus conclusively prove that when the pylorus is patent a gastrojejunostomy will not divert the chyme from the duodenum into the jejunum. Consequently, when we have to do with a duodenal fistula it is necessary not only to establish a gastrojejunostomy but also to occlude the pylorus.

A few words as to the second point I raised, *viz.*, the best method of occluding the pylorus. Kelling proposed to accomplish this by three superimposed layers of sero-muscular sutures placed parallel to the long axis of the pylorus, thus infolding the pylorus, and then to kink the pylorus by suturing this end of the stomach to the first and second portions of the duodenum. However applicable this method may be when we have to do with normal serous coverings of the stomach and

duodenum, it evidently is not applicable when the peritoneal surfaces of these viscera have become brittle and friable and fixed in inflammatory exudate; for the sutures will invariably tear and cut out and leave the parts in their primary condition. In the inflamed and altered condition of the serous surfaces of the pyloric region of the stomach and duodenum we must in order to occlude the pylorus resort to a circular ligature. In the application of this ligature the greatest care must be observed not to constrict the parts, for otherwise this ligature will cut through the pylorus and thus again establish the very condition which we are striving to relieve. There was evidence of such a tendency for the ligature to cut through the pylorus in the first case presented, although I exercised the greatest care in its application. This tendency is all the more pronounced in these cases because of the usual poor vitality of such patients' tissues. In my second case I employed a broad band of tape, which was held in position by a silk ligature, the knot of the latter resting on the tape. This seems to be the best procedure, though my second patient did not live long enough after its application to test its final adequacy and adaptability.

It is pertinent at this point to consider whether in cases of ruptured duodenum that may be followed by a fistulous opening it is advisable to resort to a primary gastrojejunostomy and pyloric occlusion in addition to repairing the opening in the duodenum, or to content ourselves at the first operation with direct repair of the perforated viscus. This question can, in the light of our present experience as to the probable ultimate sufficiency of an intestinal suture, be answered. If the peritoneal surfaces surrounding the perforated part are normal in character and are not brittle or friable or fixed in inflammatory or neoplastic exudate, we have every reason to expect a successful issue to our efforts at repair by suture; but if this healthy yielding condition of the surrounding peritoneal surfaces does not exist it is not likely that the healing by suture will occur, and in such cases it would be wiser, if the patient's condition permits of it, to at once proceed to gastrojejunostomy and pyloric occlusion. Again, if by the suture we constrict the

lumen of the duodenum sufficiently to interfere with the transmission through it of the chyme, it is likewise best to at once proceed to gastrojejunostomy and pyloric occlusion.

But if a primary gastrojejunostomy and pyloric occlusion has not been done we should at once perform them, when the suture of the duodenal opening proves itself insufficient; for repeated attempts at repair of the viscus by suture will almost invariably result in failure to effect its closure and this will be followed by the death of the patient.

The suggestion may be made that a jejunostomy will accomplish all that pyloric occlusion and gastrojejunostomy will, and that, with much less bother and difficulty. In answer to this proposition, however, it is only necessary to recall the sad experiences with jejunostomy in von Eiselberg's clinic. In this clinic, jejunostomy practised for ulcer of the stomach has been attended by the frightful mortality of 44 per cent. My own experience with the operation in complicated cases of ulcer bears out this unfavorable opinion and I would be loath to employ it when I could accomplish by another operation all that could be done by this one. Why it is that jejunostomy is attended by such unfavorable results is not quite clear, except that gastric digestion is entirely done away with, and that the secretion of pancreatic juice and bile is not maintained at its normal amount when the food is put directly into the jejunum.

ILEOCÆCAL INTUSSUSCEPTION DUE TO MYO-ADENOMA OF THE ILEUM.

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A SCHOOLGIRL, aged sixteen years, who had always enjoyed good health, was seized January 12, 1907, with severe "cramps." The first paroxysms quickly passed away, and she was able to be about although the pains recurred at frequent intervals during the following four days. The pains were more or less general over the whole abdomen. Her bowels had moved regularly. It was not possible to ascertain the character of the stools. The patient did not vomit, nor did she feel nauseated at any time during these four days or complain of having suffered in any other way excepting from "cramps." There had been no chill nor fever.

About 2.30 P.M., January 16, she was seized with "cramps" very much more severe than she had suffered in the last four days, and I was called to see her. She was lying on her back with her right thigh drawn up and was evidently suffering the greatest agony. Occasionally she would turn over and lie flat on her abdomen. She complained of having constant pain over her whole abdomen with acute exacerbations of a colicky character which were also not localized. Her pulse was 86, of good volume and regular. Her temperature by mouth was 96.5 degrees, and by rectum normal.

On inspection the abdominal wall just below and to the right of the umbilicus was seen to protrude slightly and this protrusion or swelling transmitted the pulsation of the abdominal aorta. Palpation revealed a mass about the size of a large orange which extended just a trifle to the left of the median line and not quite to the anterior superior iliac spine. A line drawn from the umbilicus to the superior iliac spine almost bisected the mass, passing a little lower, possibly, than the centre. The swelling was painful on palpation, especially so when pressure was brought to bear over McBurney's point. There was

rigidity of the right rectus. No other portion of the abdomen was rigid or painful on pressure. Percussion showed dullness over the mass, which was completely surrounded, even below and to the right, by a resonant or tympanitic area. During the examination the patient vomited some whiskey and Jamaica ginger which had been given her by her parents. This was the only time she had vomited. Rectal examination showed the uterus and its appendages to be normal.

The patient was given an eighth of a grain of morphia and sent to the Bethesda Hospital in an ambulance. A high enema was given her, but it had no influence on the size or location of the swelling.

An operation was advised, and, assisted by Dr. Percy Shields, I made an incision through the border of the right rectus over the centre of the mass. The omentum presented itself in the incision at once and quite a quantity of clear serum escaped from the abdominal cavity. Examination quickly revealed the fact that the appendix was not the cause of the swelling, although it was bound down and surrounded by adhesions and was subsequently removed.

The mass was seen to consist of several coils of greatly distended small intestine, which was delivered out of the wound with great difficulty, being apparently bound to the posterior abdominal wall. On this account it was with great difficulty that we were able to determine the nature of the trouble. It proved, on close examination, to be an intussusception of the ileum, which could be traced through the ileocæcal valve into the colon. My finger introduced alongside of the intussusceptum showed no adhesions to be present, but a constriction was felt about an inch within, which apparently prevented a reduction of the invagination. At the suggestion of Dr. Shields this was dilated, but only after considerable effort, and the intussusceptum was gradually withdrawn from its sheath, a large quantity of clear serum escaping at the same time. The gut for a distance of 14 or 15 inches was involved and was congested to a very dark blue. The peritoneal surface was glistening and intact. Hot towels were applied until the gut became more normal. On examining the invaginated gut a pedunculated tumor could be felt within the intestinal canal. An incision was made into the gut, and the tumor, which beyond a doubt was the cause of the invagination, was removed after its

pedicle had been transfixed and ligated. It was this tumor which to a large extent rendered the reduction of the intussusception so difficult.

The tumor was about half again as large as a hazel nut. It was attached to the intestinal wall by a pedicle, which for the size of the tumor was comparatively broad. Microscopical examination of the tumor showed it to be a myoadenoma. The adenomatous portion is of the tubular variety and shows in places a slight tendency to cyst formation. The interstitial portion is largely made up of involuntary muscle. Covering the surface of the tumor we find ordinary intestinal villi. The seat of the tumor was in the mucosa.

According to the literature at my disposal, myoadenomas are of rare occurrence and are usually found in the duodenum; in this case it was located in the ileum. This tumor is not to be confounded with multiple polypoid tumors, which are papillomas and are of much commoner occurrence.

The patient made an uninterrupted and uneventful recovery. The skin sutures were removed on the tenth day, the wound having healed by primary union.

THE SURGICAL TREATMENT OF SPLANCHNOPTOSIS.*

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THE abdominal viscera are kept in their normal position by a nice adjustment of the intra-abdominal tension and the various suspending ligaments. If, in the effort of lifting, or anything else that increases the tension, the muscles are not equal to the increased work put upon them and begin to stretch, the mesentery, mesocolon, gastrohepatic omentum, etc., become taut and thus prevent any further pressure against the abdominal muscles, and no harm results. On the contrary, if an unusually heavy meal, or undue loading of the viscera with solids, or liquids, causes dragging on their several ligaments, the natural tonicity of the abdominal muscles prevents the viscera from being displaced too far, and does not allow too great a strain on the suspending ligaments.

As long as this balance between ligaments and abdominal muscles is maintained splachnoptosis is impossible. If for any reason it is interrupted, prolapse of the viscera sooner or later is certain. Relaxation of the abdominal muscles, with consequent decrease of intra-abdominal tension, puts an extra load on the suspensory ligaments. They may bear the increased burden for a time, but if it continues they will become gradually elongated and attenuated, and visceral prolapse is the result.

If the weak place is within and the ligaments are first to lose their tone, the abdominal muscles will almost surely gradually relax, and the same condition, splachnoptosis, results.

In most cases I believe the relaxation of muscles or ligaments is due to a general malnutrition, and it would be hard to determine which was the first to give way. Probably many

* Read before the Western Surgical and Gynecological Association, Salt Lake City, Utah, August 31, 1906.

times the stretching of muscles and ligaments is simultaneous, both due to the bodily tone being below par.

Dr. Harris has shown that the kidney is forced out of its normal position because of narrowing of the lower thorax and upper abdomen. This is probably many times a causative factor in general visceral ptosis. I am inclined to believe that in many of the cases the narrowing about the arch of the ribs is an effect and not a cause. When splanchnoptosis exists the most of the abdominal viscera are below the umbilicus. The tendency to produce a vacuum in the upper abdomen causes sinking in at the epigastric region and gradual recession of the lower ribs.

As soon as the descensus of the viscera is an accomplished fact, a train of disagreeable symptoms is manifest. The digestion is impaired, stomach drainage is slow and imperfect, the gastric walls become stretched, intestinal gas is troublesome and painful and constipation becomes pronounced, a greater or less degree of autotoxæmia is always present, and many nervous manifestations occur. In the hands of too many the case is regarded as neurasthenic, but the nervousness should be recognized as only a symptom. Tenderness over all parts of the abdomen is another of the almost invariable symptoms of splanchnoptosis.

That this chain of symptoms is the natural result of visceral prolapse is clear if one stops to think of all the offices served by the suspending ligaments. The blood supply and enervation of the viscera come through the arteries, veins and nerves contained in their ligaments. If these ligaments are elongated, the result can be easily foretold. The return circulation is impeded, and a passive congestion results with decrease in nutrition of the coats of the viscera and perversion of their function. The nerves being stretched, pain and tenderness ensue.

Another important office of the ligaments is to hold the hollow viscera in the most advantageous position to secure results from peristalsis. A viscus in the physiological act of peristalsis, and not held steady by a normal suspensory liga-

ment, works at such a decided disadvantage that little is accomplished. It struggles, to be sure, but its power is not directed properly and the effect is largely lost.

Another function of normal ligaments is to maintain an easy curve in all portions of the gastro-intestinal canal, and thus expedite the smooth and rapid progress of food and food residue from stomach to anus. When these ligaments become overstretched these easy curves are lost and torsion, valvular constrictions, and angulations add much to the distress of the patient, and greatly interfere with his nutrition.

Whatever the remote cause of the condition a fully developed splanchnoptosis presents two anatomical changes that must be reckoned with, the weakened muscular wall of the abdomen and the stretched and attenuated ligaments. To these must usually be added dilatation, to a greater or less degree, of the stomach and intestines, and increased weight of the solid organs, liver, kidneys, and spleen, due to the long-continued passive congestion. The tendency is for the trouble to become progressively worse, for the abdominal muscles to become weaker and thinner, the suspensory ligaments longer and more attenuated, the dilatation and enlargement of the viscera more pronounced.

No treatment, medical, mechanical or surgical, will be successful that does not recognize all the disturbing factors. I do not for a moment believe that any case of extreme splanchnoptosis was ever cured by medical or mechanical treatment. The mild cases do not cause much trouble if left to themselves; and if treated intelligently with the idea of aiding digestion by suitable diet, relieving constipation, and strengthening the abdominal muscles by massage, the descensus may not increase. The severer cases may be sufficiently mitigated by well-known methods to render life bearable. But when the liver drops down three to six inches, the stomach lies below the level of the umbilicus, the mesentery is elongated to double or triple its normal length, and the kidneys move about at will, no difference what the treatment, medical or mechanical, and no matter how persistently the treatment is carried out, the viscera will

remain outside their natural orbits, although sometimes the condition may be made less distressing.

Nine years ago, when I read my first paper on this subject and reported two cases operated on, the criticism was so harsh that I made up my mind to be extremely conservative in the future, and not to operate on any cases unless all possible effort had first been made by all the known medical and mechanical means to relieve the more serious symptoms, and even then not to operate on anyone unless the condition was so severe that life had become practically no longer bearable. This resolution has been strictly adhered to, but I have seven additional cases to report to-day, not counting a large number of nephropexies which will not be considered now, as the time will be more than filled in considering the methods of correcting the descensus of the liver, stomach, and intestines; I will only say that I have considered the kidney by itself. When a movable kidney unquestionably produces serious disturbance, whether or not associated with a general splanchnoptosis, it is anchored. I have been well satisfied with the method advocated in a paper read before this Association in Chicago in 1901.

The charge against operative intervention in splanchnoptosis is that it does not fully relieve and that the correction of the displacement is not permanent. To the first charge the results in my own cases, as well as in the majority of those reported, will bear comparison with the medical treatment of the same cases. Almost every report shows that all medical measures had been tried and failed before operation was thought of. I am willing for any competent internist to have all the opportunity he desires to relieve the condition by non-surgical means in any case that comes into my hands. If he succeeds, well and good; if he fails, it will be time enough then for operative intervention. I hope I have made it plain that no indiscriminate recommendation for operation in all cases of splanchnoptosis is intended.

And now what have been the results of the operations thus far done for general visceral prolapse? In more than seventy cases whose reports I have read, done by all methods, practi-

cally all have been improved. The majority have been so much benefited as to have considered themselves cured, and a good percentage have been reported as wholly cured. In the very nature of the trouble it would be too much to expect that the results would be brilliant. These unfortunate patients cannot be made over. Their tissues are of too poor quality. All that it is reasonable to demand is that these chronic invalids, better dead than alive in their present condition, be so improved that they can again enjoy life, even if denied the vigor of their more fortunate fellows who have never been so afflicted.

There should be a sharp line drawn between true general splanchnoptosis, such as I have endeavored to describe, and those cases where the viscera have been drawn out of position by adhesions. The latter are not regarded in the same category as the former and usually relief of the adhesions would cure without any suspending operation. Only two of my nine cases could in any manner be placed in the latter class.

Various operative procedures have been tried, and it is noteworthy that all the methods seem to have given more or less relief of the more urgent symptoms. Two distinct classes of operations have their adherents:

(1) The prolapsed viscera are in some way sutured or suspended in as nearly the normal position as possible; (2) The abdominal capacity is sought to be decreased by narrowing the abdominal wall by plastic methods.

In the correction of gastropptosis by the first or direct suspension, four different methods have been advocated. In the chronological order of the published reports, they are as follows:

(1) Direct suture of the stomach wall to the abdominal wall (Duret, 1894). Gastropexy.

(2) Suture of the gastrohepatic and gastrophrenic ligaments to the abdominal wall (Davis, 1897). Gastrosuspension.

(3) Shortening of the gastrohepatic and gastrophrenic ligaments (Beyea, 1899, though his first case was operated upon in 1897).

(4) Suspending the stomach in a hammock made by suturing the omentum to the abdominal wall (Coffey, 1902).

Numerous variations of these procedures have been used, but I believe none of them are important, and all follow the principles of one of these four methods.

Two procedures have been used to narrow the abdominal wall and thus lift the viscera to their normal positions: (1) A shortening and tightening of the abdominal wall in all its diameters by an extensive plastic operation (Depage, 1893).

(2) Resection and suture of the fascia of the recti muscles when there is a wide diastasis (Webster, 1901).

In addition to these procedures gastroplication has been done for dilatation and gastro-enterostomy for drainage of the stomach, poor drainage being regarded by many as the chief cause of distress.

None of these procedures has met with a very cordial reception at the hands of surgeons or internists. None of them can be expected to so perfectly correct the position that the stomach will be as smooth in all its functions as before gastroposis occurred.

Which operation is the best is not an easy matter to decide. That direct fixation of the stomach to the abdominal wall as done by Duret, Rovsing, and Hartman, and so recently done and advocated by Eve, has serious objections, I pointed out September 16, 1897, in a paper read before the Medical Society of the Missouri Valley, when my first two cases were reported, in the following words:

"As all will recognize, the methods adopted by me are a wide departure from those hitherto practised. In operations reported, the stomach has been anchored in position by suturing it directly to the peritoneal layer of the abdominal wall. Surgeons have frequently been called upon to liberate adhesions binding the stomach to the abdominal wall, on account of the suffering caused. I should hesitate to produce artificially a condition which is so likely to be followed by pain. On the other hand, the lesser omentum is the natural ligament of the

stomach, and if it is shortened or receives a new fastening no unpleasant consequences would be expected to follow."

This is a grave objection to gastropexy by the Duret method, and I had supposed it had become obsolete, having been replaced by suspensions through the medium of the ligaments, but was greatly surprised to find an article by Frederic Eve, Surgeon to the London Hospital, as late as April 7, 1906, in which he reports five cases he had operated upon for gastropotosis in three of which he made direct fixation of the stomach to the abdominal wall two inches above the umbilicus. Eve gives as his reason, in one of these cases, for not shortening the lesser omentum, that it was too weak and friable to be depended on. Subject to active peristalsis as the stomach is, it does not seem reasonable that direct fixation will prove satisfactory.

With reference to my method published in 1897, suture of the small omentum near its attachment to the lesser curvature to the abdominal wall as high as possible, it has proven highly satisfactory in the seven cases on which the operation has been done. It is of no more a fixation than the Beyea operation, the stomach swinging from the abdominal wall with the lesser omentum as its ligament instead of from the liver and diaphragm. In two of my nine operations the Beyea method was used. The results were as good as, but no better than, in the seven in which my method was made use of. The chief claim for my method is that it is easier to do, and seems less likely to interfere with the circulation. Again, in many of these cases a hepatopexy is needed at the same time, and it is as well not to have the extra weight of the stomach and colon pulling down on the liver.

I have never made use of the method of Coffey, suspending the stomach in a hammock by fastening the omentum to the abdominal wall. It seems rational and especially applicable in such a case as Eve describes with a lesser omentum so weak as not to be equal to the task of supporting the stomach. The only objection I can see is the possibility of a rotation of the stomach on its axis sufficient to develop a kink at the pylorus.

Gastroplication, in cases of dilatation, seems of little value. If the dilatation is dependent on descensus, when the stomach is raised to its normal position, it will very soon regain its natural size. On the other hand, after plication the dilatation will quickly recur unless the valvular obstruction at the pylorus is corrected.

Gastro-enterostomy has strong advocates, notably Deaver and Walker, and has apparently been followed by fairly satisfactory results. It does not pretend to correct the displacement; it merely prevents the stagnation dependent on the descensus. If, by suspension, the angulation at the pylorus is removed so that the stomach can empty normally the need of gastro-enterostomy no longer exists. That suspension does this has been proven many times. Gastro-enterostomy, even in the hands of the best operators, still has considerable mortality while the suspending operation is practically mortality-free.

The operation of Depage, lessening the capacity of the abdomen by shortening its wall in all its diameters, seems rational, but has serious objections. The ligaments are not shortened, and the unsupported weight of the viscera can scarcely fail to produce a second stretching of the abdominal wall. It seems also to be impossible to accomplish the extensive resection of the wall, as done by Depage, without destroying much of the nerve supply, with resultant paralysis of the muscles and almost certain production of hernia in the course of time, thus producing a condition much worse than the original. The operation is formidable, one of the three cases reported by Depage having died of shock.

The same objections do not apply to the Webster operation, but the diameter mainly at fault is not narrowed. In my observations the worst cases of splanchnoptosis are associated with greater stretching of the vertical than of the transverse diameter.

Whatever suspending operation is adopted, if careful attention is not given to the after-treatment, failure is invited. Several weeks in bed with vigorous massage of the abdominal wall and forced feeding after the operation, seems to promise

most in the extreme cases of splachnoptosis not relieveable by mechanical and medical means.

In prolapse of the liver Jonas' method of holding up the anterior border by means of the gall-bladder sutured to the abdominal wall, and the method described by Coffey, of shortening the suspensory ligament and reinforcing this by sutures through the liver substance and the abdominal wall, have been used successfully. I have tried both methods, but am coming to depend more and more on shortening of the suspensory and round ligaments.

For prolapse of the transverse colon, Lambotte's method of suturing the wall of the colon directly to the abdominal wall is to be condemned on the same grounds that we condemn direct gastrofixation. It is inviting trouble. The method devised by Coffey for suspending the stomach in a hammock by suturing the great omentum to the abdominal wall, seems even more satisfactory for holding up a prolapsed transverse colon.

In my first case, reported in 1897, the gastrocolic omentum was very long, more than twice its normal length, allowing the transverse colon, after the stomach had been restored to its normal position, to descend much lower than it should. At this time the gastrocolic omentum was reefed by sutures carefully placed so as to avoid interference with the blood-supply. The results were entirely satisfactory, but only one case has been met since, which seemed to require such a procedure, Case VI, in which it was done with apparently perfect success.

Apparently most contributors to the surgical literature of splachnoptosis ignore the existence of enteroptosis, or consider that suspending the stomach corrects the entire trouble, without any direct effort directed to the small intestines. In most cases this is probably true, but sometimes the mesentery is stretched to two or three times its natural length. In such a condition I can see little benefit in suspending the stomach and liver alone. The buoyancy of the small intestines, forming a veritable air-cushion on which the liver and stomach rest and constituting no little part towards holding these organs in their

normal position, is lost if the intestines sink to the lowest part of the abdominal cavity, as they do when the mesentery is greatly elongated.

In three cases I have shortened the mesentery in the manner described in Case I, reported in 1897. It is done in much the same manner as Beyea shortens the gastrohepatic omentum, except that, instead of folding the membrane on itself by tier suture, only one suture is introduced between the arteriæ intestinæ tenuis, and when it is tied it produces a reef. Many of these sutures are used, and as they are tied the mesentery is shortened as much as desired.

All of my cases have done well, as will be seen by reference to the reports at the end of this article. The putting in of these reefs is not nearly so formidable an operation as it seems, if it is carefully done and the blood-supply duly respected. If we expect to accomplish good results in the surgical treatment of splanchnoptosis all of the prolapsed viscera will have to receive attention in the more aggravated cases.

A brief history of cases operated upon is hereto appended.

CASE I.—Mr. E., farmer, aged 62 years. Reported in *Western Medical Review*, October 15, 1897. Will quote from the description of the operation only to show the technic employed: "The stomach was drawn up into its normal position, and the lesser omentum near its reflection upon the stomach at its lesser curvature was fastened to the peritoneum (in a transverse direction) at the level of the ensiform cartilage by means of fine silk sutures. The stomach was not especially dilated, and gastroplication was not performed. The transverse colon was fully six inches from the greater curvature, the gastrocolic omentum having been greatly stretched. A tuck was taken in the gastrocolic omentum, being careful to avoid the vessels, and not allowing the sutures to penetrate more deeply than through the anterior peritoneal layer of the omentum. This shortened the distance between the transverse colon and greater curvature of the stomach to two or three inches. The small intestines were now brought forward and the mesentery found to be so much elongated that the loops of intestines could be raised four or five

inches above the level of the abdominal wall without undue tension. Beginning now near the upper end of the jejunum, a loop was brought forward. To shorten the mesentery without interference with the intestinal blood supply was the problem before me. The isosceles triangles, bounded at the base by the attached border of the intestine and having for their sides the arteriæ intestinæ tenuis, branches of the superior mesenteric, were elongated, the distance from their apices to their bases being three to four inches. Anything might be done to shorten these triangles if there was no interference with the circulation at their borders. Armed with a long, slender needle, carrying No. 4 silk, the needle was inserted near the apex of a triangle penetrating the mesentery in one direction and brought through in the opposite direction at the centre of the base near the attached border. The suture was drawn through and tied, forming a reef in the mesentery at this point and shortening it from two to three inches. After several sutures had thus been introduced and tied in contiguous triangles, close examination showed that the circulation was unimpeded. Sutures were thus used the entire length of the small intestine, not in every interarterial space, but almost that closely. Between the upper jejunum and the ileocaecal valve ninety-two sutures were employed. There was no shock. The patient did well with the exception of some pain in the region of the loosened adhesions. There was no distension. The bowels moved the third day. The patient was up the twentieth day, and left the hospital August 9, exactly four weeks from the day of operation."

CASE II.—Mrs. P., aged 30 years. Reported same time as Case I. Four months after the operation she was doing her own housework, which she had not been able to do for many months, and had gained seventeen and one-half pounds in weight. She had a child about two years after the operation, and was reported in good health one year ago.

CASE III.—Mrs. C. W., aged 26 years. No children; one miscarriage. Three years ago she began having pain in region of stomach and gall-bladder; no acute attacks, but constant pain and distress. Has lost much weight, but cannot say how much.

Has been under Dr. Bridges' care for several weeks in the M. E. Hospital. On examination general abdominal tenderness was present; worst over gall-bladder region. Liver in about

normal position, but stomach greatly prolapsed, extending three inches below umbilicus.

Operation, December 22, 1904. Dr. Decker gave ether; Dr. Hull assisted. Incision through right rectus. Thirty stones removed, and gall-bladder drained. Stomach anchored as in Case I. Uneventful recovery, and reported well six months later.

CASE IV.—Mrs. H. S., aged 23 years. One child; one miscarriage. Began having pain in region of stomach and gall-bladder three years ago, and has been growing worse ever since, having lost twenty-five pounds in weight. General abdominal tenderness; no worse over stomach and gall-bladder than elsewhere. Liver greatly prolapsed, and stomach extends below umbilicus. Also has laceration of cervix and perineum.

Operation, January 10, 1905, at M. E. Hospital. Dr. Decker gave ether, and Dr. Hull assisted. Uterus curetted, and cervix and perineum repaired. Then the liver was raised to its normal position and sutured there by stitches through its border. As this was found to restore the stomach to its normal position, it was not anchored. Gall-bladder normal.

Patient made an uninterrupted recovery; all the old pain relieved; and she was in good condition four months later.

CASE V.—Mrs. E. R., aged 27 years; two children; no miscarriages. A year before entering Immanuel Hospital she commenced to feel pain in the left side of the abdomen. The only position of comfort was on her back. Almost impossible to remain long in the upright position. Frequent vomiting and sick headaches. Constipated. The entire abdomen sore, and has a burning sensation. Much flatulency. At the beginning of her trouble was jaundiced, but had no attacks of colic.

Lower border of stomach midway between umbilicus and pubes; liver also much prolapsed. Both kidneys movable.

Operation, August 19, 1905. Dr. Mason gave ether, and Dr. Hull assisted. Incision in median line above umbilicus. Liver and stomach anchored in usual manner. Made an uninterrupted recovery, but has not been heard from since leaving hospital.

CASE VI.—Mrs. J. M., aged 40 years; seven children; no miscarriages. Good health until the past few years, when she began having pain in abdomen, flatulency, constipation, etc.,

which was not very severe until a year ago, since which time she has been much of the time confined to her bed under the care of her physician, Dr. Fitzsimmons, of Ohiowa, Nebraska. During the year her weight has decreased from 127 pounds to 97 pounds.

For one month before I saw her she was in Immanuel Hospital under the care of Dr. Milroy, who asked me to see her.

Abdomen universally tender; food causes great distress; nausea and often vomiting. A general splanchnoptosis diagnosed, the liver being three inches below the arch of the ribs, and the stomach entirely below the umbilicus when she stands, with bulging of the lower abdomen. Operation was advised, and with the hearty coöperation of Dr. Milroy and Dr. Fitzsimmons it was carried out November 2, 1905.

Incision in median line from ensiform cartilage to umbilicus. Liver anchored by four double sutures. Stomach anchored and the gastrocolic omentum shortened as in Case I. Numerous reefs taken in mesentery throughout the entire length of the small intestine, the mesentery being greatly lengthened. Uneventful recovery. When she left the hospital, five weeks after operation, she felt better than for many months. Advices from her two weeks ago state that her health is excellent.

CASE VII.—Mrs. M. B., aged 39 years; three children; no miscarriage. Has been having a good deal of pain in abdomen, and flatulency for past year. Constipated. Much worse during past month, and has resisted all treatment. Pain has of late been worse in the left half of the abdomen. The patient has been steadily losing weight.

On examination a general splanchnoptosis found; kidneys, liver and stomach all much prolapsed.

Operation, January 5, 1906. Dr. Mason gave ether, and Dr. Hull assisted. Incision above umbilicus through right rectus. Numerous adhesions found between omentum and anterior abdominal wall. These were broken up, and the liver was raised to its normal position and anchored. The stomach was then suspended by suturing the lesser omentum to the abdominal wall high up. The gall-bladder was normal with the exception of a few adhesions, which were broken up. Through this incision a small fibroid was found on the anterior surface of the uterus, and an adherent left tube. A low incision was now made, and the

fibroid enucleated. The left tube and ovary were found to be tubercular and were removed. The adhesions were probably due to a healed tubercular peritonitis.

The patient made a good recovery, and was discharged from the hospital much improved, but I have not been able to hear from her since.

CASE VIII.—Mrs. J. S. J., aged 59 years ; has four children ; no miscarriages. About four years ago she commenced to have stomach symptoms—pain in region of stomach, eructations of gas, vomiting, and a considerable amount of nausea most of the time. These symptoms have gradually increased in severity, until she has been reduced to a condition of chronic invalidism, being compelled to keep her bed most of the time.

Examination reveals a prolapsed liver to three inches below the arch of the ribs, and the stomach greatly prolapsed, the lesser curvature half way to the pubes. Tenderness almost everywhere over the abdomen, no greater in the regions of the stomach and gall-bladder than in other regions. Before I saw her Dr. Christie had been treating her in Immanuel Hospital for four weeks, and it was by his advice that the operation was done. Her pain before coming to the hospital had been so constant that she had become more or less a morphine habitué.

Operation, July 27, 1906. Ether given by Dr. Stein, Dr. C. A. Hull assisting. Incision in median line from the sternum to the umbilicus. On opening the peritoneum, in addition to the prolapse described, numerous adhesions were found in the region of the gall-bladder, which was found atrophied and containing several stones, which were removed and the gall-bladder drained in the usual manner. Hepatopexy was first done, using sutures through the border of the liver and the peritoneum as high as possible and also suturing the suspensory ligament. The Beyea method was made use of to shorten the gastrohepatic and gastro-phrenic ligaments.

The patient has been undergoing rest and massage treatment, but is now about the hospital almost ready for discharge. She still has some pain, but not to compare with what she had before the operation.

CASE IX.—Mrs. L. H., aged 35 years ; two children ; two miscarriages. For past two years she has had much gastric and abdominal pain, and for the past year has been most of the time

confined to bed. Vomits frequently; has constipation; resists all treatment.

On examination the liver and stomach were found greatly prolapsed, the greater curvature reaching almost to pubes.

Operation, August 18, 1906, at Immanuel Hospital. Incision above the umbilicus. Liver pushed up into place and anchored. Stomach suspended by the Beyea method. At the present time she is doing well, and has much less pain.

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TRANSACTIONS OF THE NEW YORK SURGICAL SOCIETY.

Stated Meeting, January 23, 1907.

The President, DR. GEORGE WOOLSEY, in the Chair.

MALIGNANT DISEASE OF THE STOMACH.

DR. JOSEPH A. BLAKE presented a series of three cases as follows:

CASE I.—A man sixty-five years old, who had been operated on ten months before for carcinoma of the pylorus. For three or four years prior to the operation he had had dyspeptic symptoms, consisting chiefly in sour stomach and eructations of gas. In the year previous to operation he had occasional attacks of vomiting, gradually becoming more frequent, and at times large in amount. He had suffered some pain after eating, accompanied by a sensation of fulness and distention which was relieved by vomiting. In the year preceding operation he had lost about thirty pounds in weight. The patient would not allow the passage of a stomach tube. Examination of the vomitus showed combined acid about 60; at times, no free hydrochloric acid; at other times free hydrochloric, 26. There was no lactic acid and no evidence of prolonged retention.

At the operation, which was done on March 31, 1906, an annular growth, $1\frac{1}{2}$ inches in diameter, was found occupying the site of the pylorus, constricting its lumen for one quarter of an inch. The lymphatics were enlarged along the lesser curvature as far as the cardia. There was a large lymph node alongside the duodenum, close to the pancreas. The growth, with the stomach as far as the cardia, was removed, including the lymph nodes. The ends of the duodenum and the stomach were closed, and a

posterior gastrojejunostomy was done by means of a Murphy button with a short loop.

The patient sat up in bed the second day after the operation. He was able to shave himself three days later, and was out of bed on the eighth day. On account of the Murphy button he was kept on fluid diet until the eleventh day, when the button was passed.

Immediately after the operation, he weighed 108 pounds. Four months later he weighed 148 pounds and his present weight is 144 pounds. He had enjoyed perfectly good health, and was attending to his business. There were no symptoms referable to the stomach, excepting that he found that frequent small meals agreed with him better than meals taken at the usual intervals. Examination of the growth showed it to be adenocarcinoma.

CASE II.—A man, forty-one years old, upon whom Dr. Blake had operated eight months ago at the Roosevelt Hospital for carcinoma of the pylorus. The patient had complained of symptoms for twelve months preceding the operation. The first symptoms were a heavy feeling in the epigastrium, and eructations of gas and sour fluid. For eight months he had had obstructive vomiting. There had been no pain, no hæmatemesis, and no blood in the stools. He had lost thirty pounds during the year.

Upon examination, a mass about the size of an egg was felt in the right hypochondrium. There was a distinct splashing sound, and peristaltic waves were evident. The stomach reached two fingers below the umbilicus. The gastric analysis, after a test meal, showed free hydrochloric acid, 14; combined hydrochloric, 37; total acidity, 72; no lactic acid. Starch and glucose were present; no blood; no bacteria.

At operation, a growth was found at the pylorus about 2 inches long by $1\frac{1}{2}$ inches in diameter, and there were slight lymphatic extensions along the lesser curvature. The mass was movable, and there were no adhesions. The stomach was greatly dilated, extending 2 inches below the umbilicus. The growth, with about 6 inches of the stomach, was excised, the line of excision extending from the cardia to the greater curvature. The end of the duodenum was closed and inverted, and a posterior gastrojejunostomy was done with clamp and suture. Water was given by mouth the day of operation, and the quantity was gradually increased, until the patient was taking 4 ounces every four hours.

The patient vomited once after the operation. On the day after the operation, peptonized milk was given commencing with one drachm, and increased to 2 ounces every two hours. Three days after the operation he was given beef broth, beef juice and egg nog, and on the following day cereals, soft cooked eggs and milk toast. He was kept sitting up in bed as much as possible every day, commencing the day after operation, and was out of bed on the eighth day and allowed to walk on the eleventh day.

The patient's weight, on admission, was 97 pounds. Nine days after the operation he weighed 107 pounds; thirteen days after the operation 112 pounds, and three months after the operation 147 pounds. His present weight is 171 pounds a gain of 74 pounds.

The microscopical examination of the growth showed it to be carcinoma.

CASE III.—A woman, forty-nine years of age, who had been operated upon for hæmorrhages from a gastric ulcer, a gastro-enterostomy having been done. This resulted in a "vicious circle," which was finally cured by division of the pylorus.

The patient gave the following history: Thirty-three years before, when sixteen years of age, she suffered from dyspepsia and heartburn, with sour eructations. Thirteen years before she had had an attack of epigastric pain, and vomited a lot of coffee-ground material, with blood. Four years before she had again vomited blood. Since that time she had noticed that at times her stools had been tarry. For two weeks before her admission to Roosevelt Hospital she had repeatedly vomited large amounts of blood.

Upon admission, her red blood cells were 1,740,000; hæmoglobin, 40 per cent. The test meal showed moderate hyperacidity. There was tenderness and slight muscular rigidity over the epigastrium, and apparently slight dilatation of the stomach; no tumor was felt. While in the hospital, before operation, she had continuous hæmorrhages from the stomach, small in amount.

On September 15, 1906, she was operated on by Dr. L. C. Hotchkiss, who was then on duty, and a posterior gastro-enterostomy was performed by the Peterson method, that is, without an enterostomy, by the short loop. There was apparently a cicatrix at the pylorus, and the pylorus was reddened, but not adherent. Following the operation there was persistent vomiting, the quan-

tities varying from 2 to 4 ounces two to six times daily. Lavage obtained large amounts—1 to 3 pints—of greenish, foul fluid. The patient began to lose weight, and failed continuously.

On October 16, one month after the first operation, the abdomen was again opened. Some adhesions were found beneath the line of suture, but the anastomosis was technically perfect, the stoma being wide open. There were no adhesions about the pylorus nor in the region of the anastomosis; there was marked dilatation of the stomach and of the entire duodenum. The pylorus was divided, and the ends of the duodenum and of the stomach turned in and closed. The operation was followed by gradual improvement. The vomiting continued, but it was less frequent and gradually subsided entirely, although lavage still brought back some bile-stained fluid. Eleven days after the operation, the patient, while vomiting, burst open the abdominal wound, there having been no effort at repair on the part of the tissues. This was due partly to the patient's asthenic and starved condition and to the fact that the incision of the second operation was in the median line and opposite the first incision. The wound was resutured under cocaine with through-and-through stitches of silkworm gut.

The patient slowly improved after the second operation, and was now nearly able to return to work. There was still, however, evidences of regurgitation of intestinal contents into the stomach. An examination made during the past week showed that on fasting, 120 c.c. of greenish fluid, containing considerable mucus, bile and blood, were withdrawn from the stomach. Total acidity, 20; free hydrochloric acid, 14. At another examination after a test breakfast, 400 c.c. of greenish fluid was withdrawn, with a total acidity of 18; free hydrochloric acid, 4.

On inspection of the abdomen a peristaltic wave could be seen passing from left to right across the epigastrium and upward along the right rectus muscle to the costal margin at the eighth chondrosternal articulation.

Dr. Blake commented on the fact that a gastro-enterostomy with a short loop, even though placed at the most dependent part of the stomach and with the opening directed in the manner that Mayo had recommended, might be followed by the "vicious circle" when the pylorus was open. The division of the pylorus in this case, although improving the patient's condition, had not

proved an absolute remedy, inasmuch as there was still regurgitation of the intestinal contents into the stomach. It was also interesting to observe that although the pylorus was closed and the stoma was open, there was still an effort, as evidenced by the peristaltic wave, on the part of the stomach to force its contents through the pylorus.

DR. CHAS. H. PECK presented a man, sixty-six years old, who was operated on for carcinoma of the stomach on July 13, 1906, a partial gastrectomy by Mayo's method being done. The patient's symptoms had been gradually increasing for a period of more than five years, probably indicating that the growth developed in the base of an old ulcer. This case had already been reported in full at a meeting of the New York Surgical Society on October 24, 1906. The patient had continued to gain in flesh and strength; he could eat solid food in ample quantity without distress, and weighed 35 pounds more than at the time of operation.

PERFORATIVE LESIONS OF THE STOMACH.

DR. CHARLES H. PECK presented the following cases:

CASE I. *Perforation of the Stomach, with Spreading Peritonitis*.—A male, forty-two years old, was brought to Roosevelt Hospital on June 9, 1906, who had been taken suddenly ill with violent abdominal pain while walking in the street that morning. The pain was not relieved by an injection of morphine, and he was sent to the hospital by his physician late in the afternoon. He had been operated on about five years before for an abscess in the epigastric region, and had suffered more or less from indigestion ever since.

On admission, he presented the signs of an extensive peritonitis, with generalized tenderness and rigidity, and moderate distention. The symptoms were most marked in the right half of the abdomen, as low as the iliac fossa. A diagnosis was made of perforative appendicitis, with spreading peritonitis, and an immediate operation was done, about ten hours after the onset of the pain.

The appendix was removed through an intermuscular incision, and showed no evidence of disease excepting moderate inflammation of its external coats. There was a large quantity of turbid fluid of aromatic odor and showing oil droplets, free in the peritoneal cavity. The wound was closed, and a median incision

made in the epigastric region. A perforation on the anterior wall of the stomach was found, through which the stomach contents were escaping. The perforation was closed by a purse-string suture, buried by silk Lembert's sutures. The peritoneal cavity was thoroughly flushed out with saline solution through a Blake tube, and the wound was closed, excepting at the point of emergence of a cigarette drain, which was left down to the site of the perforation.

The patient's convalescence was uninterrupted. The wounds healed promptly, and he left the hospital on June 28, nineteen days after the operation. He had since remained in good health and without pronounced gastric symptoms.

The aromatic odor of the fluid that had been found in the peritoneal cavity, and the oil droplets which it contained, were afterwards accounted for by the statement of the patient that he had taken some fragrant preparation of castor oil shortly after the onset of his pain.

CASE II. *Perforated Gastric Ulcer; General Peritonitis.*—A female; twenty--three years old, was operated on December 17, 1905, for perforated gastric ulcer with generalized peritonitis. Symptoms of perforation had occurred twenty-nine hours before operation. The same technique was employed as in his other cases of perforation, and the patient made a good recovery. She gained in weight, and was now able to take a variety of solid foods without distress. She was presented at a meeting of the New York Surgical Society on February 28, 1906, and had now remained free from symptoms of ulcer for more than a year, in spite of the fact that no gastro-enterostomy was performed.

Dr Peck said that in addition to the two cases of acute perforation presented, he had operated upon four others during the past three years. Two of these, operated upon at four and six hours respectively from the onset of symptoms of perforation, made good recoveries, and both were well when last heard from, but could not be located at the present time. Both were shown before the New York Surgical Society on February 24, 1904. Two others, one operated on at thirty-six and the other at fifty-three hours after perforation, died of peritonitis, which was well advanced in each case at the time of operation. The same technique was employed in all six cases of acute perforation. Gastro-enterostomy was not performed, and the only drain used was a

single cigarette down to the site of perforation in event of leakage. No leakage of the stomach contents occurred in any of the six cases, although the infiltration surrounding the perforation was so great in several of the cases as to render satisfactory suturing very difficult.

CASE III. *Chronic Gastric Ulcer; Gastro-enterostomy.*—

A married woman, forty years old, was taken ill in September, 1905, with pain after eating, and vomiting. Prior to that she had always enjoyed good health. She was a moderate beer and tea drinker. Two weeks after the onset of her illness she vomited blood, and for several days her stools were tarry. The pain and vomiting persisted, and the patient lost flesh and strength. On February 23, 1906, she had another attack of hæmatemesis, followed by tarry stools. She was brought to the hospital and remained under medical treatment until the following April. Her pain and vomiting recurred soon after resuming work, and on August 11 she had another gastric hæmorrhage. Her pain always occurred soon after eating, and was relieved by vomiting. It radiated to the back and left shoulder. There was tenderness over the epigastrium. She had lost about 44 pounds in weight and was very pale. An examination of the blood showed 40 per cent. of hæmoglobin; red blood cells, 3,200,000; free hydrochloric acid, present. The case was regarded as one of chronic gastric ulcer.

Operation, August 24, 1906. An incision was made to the right of the median line, and the stomach drawn into the wound. Signs of ulcer were found on the anterior surface, near the middle of the lesser curvature. The omentum was adherent over the site of the ulcer, and the wall of the stomach was thickened and indurated. A posterior gastro-enterostomy was done by suture, with the short loop. The direction of the gut was from right to left. The opening was $1\frac{1}{2}$ inches long, and was closed by two rows of silk sutures. The edges of the wound in the mesocolon were sutured to the stomach with catgut, and the wound was closed layer by layer, without drainage, with catgut, chromic gut, silkworm and silk.

The patient was allowed water by the mouth after twelve hours, and peptonized milk on the second day. Soft solids on the seventh day. No vomiting or pain followed the operation, and her convalescence was uneventful. She was out of bed on

the eighteenth day, and left the hospital, well, two days later. She had since remained well, and had gained 15 pounds in weight. She was able to eat solid food without distress.

GASTRIC AND INTESTINAL LESIONS.

DR. LUCIUS W. HOTCHKISS presented a series of cases, as follows:

CASE I. *Pyloric Stenosis from Old Ulcer; Posterior Gastro-enterostomy*.—A boy, nineteen years old, was admitted with a long-standing history of stomach trouble. His family history was negative. He stated that he had had an osteomyelitis of the lower jaw when he was twelve years old, which prevented him from eating solid food for a period of four months. He was operated on at the time, and a greater part of the jaw was removed. It was fair to assume that during his illness he had a more or less constant septic discharge into the mouth, which, together with his inability to chew, might probably be regarded as a causative factor in the stomach trouble, which began to disturb him seriously about three years later.

About four years ago he began to have a steady, non-radiating pain in the region of the stomach, which was at first relieved somewhat by eating. For over three years he had no other symptoms. Then he began to vomit regularly, about half an hour after each meal. The vomitus was copious and sour to the taste. It had never contained blood. He also complained of eructations of gas. His appetite remained good, but the food was not long retained. During the past few months he had lost 20 pounds in weight.

Physical examination showed a poorly nourished boy, of small frame. There was slight tenderness in the epigastric region, and the stomach was visibly dilated. He had been treated under various diagnoses for many weeks without much benefit, although systematic lavage had relieved him somewhat, but he was growing constantly weaker. A gastric analysis showed a total acidity of 70; free hydrochloric acid, 44. A blood test was negative.

A gastro-enterostomy was done on December 29, 1906, from which the patient made an uninterrupted recovery. He had not vomited since the operation, and had gained 14 pounds in weight. The operation done was a posterior gastro-enterostomy by suture

after the latest method described by Mayo. It was easily performed, although there was the scar of an old ulcer, and adhesions on the posterior surface of the stomach, almost at the point selected for the anastomosis.

CASE II. *Cyst of the Mesentery of the Small Intestine; Torsion of Cyst on its Pedicle, with Strangulation and Obstruction of the Small Intestine; Beginning Peritonitis; Removal of Cyst; Resection; End-to-End Anastomosis of Gut with Murphy Button; Recovery.*—A woman, fifty years old, was admitted to Roosevelt Hospital on August 28, 1906. Her family history was negative. Her menses recurred four years after the supposed menopause, and the flow lasted a month, accompanied by cramp-like pains. This was one year ago. Since then there had been no vaginal discharge. The patient stated that twenty years ago she had an attack of illness similar to the present one, but without swelling of the abdomen. That attack lasted about a month. For the past two years she had lost flesh and strength.

One month before admission, after exertion, she had a sharp pain in the left side of the abdomen in the nipple line. This lasted about a week. During this period she also had looseness of the bowels, but she was not compelled to give up her work. About eleven days before coming to the hospital she was seized with a sharp, tearing pain in the abdomen, radiating from the right iliac fossa. She vomited frequently, felt "hot and cold," had diarrhoea, and later her abdomen began to swell. She said her vomitus was "black and sour."

When the patient was admitted to the hospital, her symptoms still persisted, and there were undoubted indications of intestinal obstruction. Examination showed a thin, little woman, with a much distended abdomen, and slight tenderness low down in the right iliac fossa. There was dulness in both flanks, and general abdominal distention, which was most marked in the epigastrium.

Operation, August 28, 1906: An incision was made through the right rectus, below the umbilicus. On introducing the hand into the peritoneal cavity to locate the seat of obstruction, a large cystic tumor was felt which was at first thought to be ovarian, but on bringing it into view it proved to be a cyst growing from the under layer of the mesentery of the small intestine. It had a considerable pedicle derived from the mesentery, and was rotated upon this pedicle, much as an ovarian cyst might be. In

its rotation, it had caused a complete obstruction, as well as strangulation and gangrene of the loop of gut involved, and about this loop, which ruptured when it was released, there was a considerable area of advancing peritonitis. The cyst was removed, and about 8 inches of gut resected. The ends of the gut were rapidly joined with the Murphy button, as the patient's condition was not promising. The abdominal wound was closed after irrigation of the peritoneal cavity with hot, normal salt solution. The convalescence was stormy, and in the course of a few days a faecal fistula developed; this at first discharged very profusely, but the amount gradually decreased, and the patient was sent home. She subsequently returned with a small, slightly discharging fistula, which is to be repaired by operation.

The cyst that had been removed was structureless, and contained clear fluid. The loop of excised intestine was reported by the pathologist to be gangrenous. The case was regarded as remarkable in that the cyst was pedunculated and very evidently the cause of the obstruction by producing a kink of the loop of small intestine at some distance from it. It was remarkable also in that it could be tied off from the mesentery without cutting off the circulation to the corresponding segment of gut which was distended above the point of obstruction. The cyst was pear-shaped, with moderately thick walls, and was about 5 inches long.

CASE III. *Adenoma of the Cæcum; Perforation; Abscess, Simulating Appendicitis; Resection of Cæcum; Lateral Anastomosis between Ileum and Ascending Colon by Suture.*—A boy, twenty-two years old, was admitted to Roosevelt Hospital on August 1, 1906. Four weeks prior to that date he had an attack of pain in the appendiceal region, and noticed a feeling of "hardness" in that locality. The pain and tenderness had lasted for two or three days, but he kept at work. The pain was dull in character, and did not radiate. A week ago he had a milder attack of pain in the same region, and noticed a lump which gradually increased in size. The pain was worse after a day's work. He kept at his occupation, however, which was that of a grocer's clerk, until the day of his admission, when he came to the hospital to find out what the lump was. He had had no chills nor vomiting, and had not noticed that he was feverish. His bowels for the past month had been regular under the use of

laxatives. He had a slight cough. His general condition was fair. His urine showed a slight trace of albumin. His temperature, on admission, was 100 degrees F.; pulse, 112. The abdomen showed a slight bulging in the right iliac region, and there was a slight sense of rigidity on that side, low down. In the right iliac fossa there was a smooth, rounded mass, about the size of an orange. This was slightly tender and flat on percussion. It seemed to be attached to the posterior wall of the abdomen. The leucocyte count was 16,400.

Operation, August 2, 1906: The muscles were split over the site of the mass in the right iliac fossa, and the incision extended when the true nature of the case was discovered. On opening the peritoneum, an encapsulated abscess was found, and the appendix was sought for and removed. As the latter organ did not show sufficient change to account for the patient's condition, a further exploration was made, and a growth involving the cæcum was discovered. The wall of the cæcum was soft, and easily perforated by the finger. The wound was enlarged by means of Weir's incision through the posterior rectal sheath, and through this the cæcum was readily isolated and delivered. The cæcum and lower end of the ileum were resected, their respective ends turned in by suture, and a lateral anastomosis effected by suture between the side of the ileum and the side of the ascending colon.

After the first week, the patient's convalescence was uneventful, and he was discharged, well, in about a month. Since then he has steadily improved in weight and strength, and he is now enjoying excellent health. The pathologist reported the growth to be an adenoma.

CASE IV. *Intra-abdominal Omental Torsion; Resection of Omentum; Recovery.*—A man of twenty-nine was admitted to Roosevelt Hospital on August 3, 1906, with the following history: Five days before admission a right-sided hernia, which had been down, reduced itself spontaneously and without pain. About the same time the patient began to have pain in the right iliac fossa. This was of a sharp, non-radiating character, which persisted and gradually grew worse. There was no history of chill nor vomiting, and no urinary symptoms. The bowels had been regular up to the time of admission. The patient had worked until two days before, and had then taken to his bed on account of

the increasing pain and the abdominal discomfort. He had had a right inguinal hernia for the past six years, which had always been reducible. During the past year the patient had worn a truss.

On admission, the patient's general condition was good. There was slight abdominal fulness on the right side, especially over the appendix. There was marked rigidity of the right rectus muscle, and a palpable mass in the appendiceal region, extending into the pelvis. This mass was moderately tender. The patient's temperature, on admission, was 101.6; pulse, 128; respirations, 24; leucocytosis, 15,200.

Operation, August 4, 1906: On account of the uncertainty of the diagnosis, a Kammerer incision was made through the right rectus, which was later extended upward above the level of the umbilicus to allow room for the necessary manipulations. On opening the peritoneal cavity, some bloody serum escaped, and a large mass was discovered occupying the lower abdomen and pelvis. This was finally made out to consist of omentum, twisted upon itself, hardened and infiltrated with serum, and apparently strangulated. The appendix was somewhat involved in the infiltration, and was removed. The omentum was found to be adherent at some point in the pelvis near the brim, and to the side of the appendix, but it was easily torn away. The internal inguinal ring was examined, and it was free from omentum. The omentum was ligated close to the transverse colon and removed.

The specimen proved to be a large mass of strangulated omentum, twisted about eight times around a narrow pedicle close to the transverse colon. The whole mass was spindle-shaped, and resembled a hepatized lung in color and consistency. It measured about 10 inches long and about 6 in diameter at its thickest point. The twists were in the long axis, and from right to left. The tip was beginning to become necrotic. The weight was between 5 and 6 pounds.

The patient had some abdominal distention on the day following the operation, but his convalescence was otherwise uneventful. The specimen, which was also shown by Dr. Hotchkiss, had preserved most of its color and contour, and illustrated fairly well the condition found at the time of operation. The patient had been perfectly well since.

A CRITICAL REVIEW OF A RECENT SERIES OF OPERATIONS
UPON THE STOMACH.

DR. GEORGE EMERSON BREWER read a paper with the above title, for which see page 687.

In connection with this paper, Dr. Brewer showed a series of cases of benign lesions of the stomach upon which he had operated at Roosevelt Hospital.

DR. ARPAD G. GERSTER said that the report of the failures so frankly included by Dr. Brewer in his interesting paper could probably be duplicated by every surgeon who had occasion to do these operations for gastric disturbance. The lesson to be drawn from such experiences was that the surgeon should be extremely conservative, especially in dealing with women, and refuse to operate in the absence of symptoms indicative of definite and characteristic pathological changes. Among his curative failures Dr. Gerster reported a case of posterior gastro-enterostomy with the Murphy button, done for the relief of a spastic stenosis, in which, probably on account of some defect in its make-up, the button failed to come away, and a radiograph showed that it was still *in situ*. The stomach was again opened, and the button withdrawn. About a month later the patient again began to complain, and upon re-opening the stomach for the third time a stenosis was found at the previous site of the button, for the relief of which a Heineke-Mikulicz plastic operation was done, and further recovery was uneventful, but the original gastric complaint remained little improved.

The speaker said he had met with cases of gastric neurosis in which the subjective symptoms were of the most puzzling and complicated character, and in which new symptoms were constantly cropping up. Dr. Mayo had recently told him that in dealing with gastric disorders in women, in the absence of hæmorrhage, or of symptoms of stenosis or tumor, demonstrated by a probatory incision, he would refuse to make anastomosis. With the present more precise methods of diagnosis that the surgeon had at his command, the results of operations upon the stomach were steadily improving. Care should be taken, however, not to confound reflex with intrinsic symptoms, and we were justified in doing gastro-enterostomy only where there were demonstrable symptoms of such gravity that they could not be mistaken. The

speaker said that of 26 gastro-enterostomies done in his service at Mt. Sinai Hospital during the past five years for ulcer and stenosis, including 2 resection, there were only 2 deaths. Once only a condition resembling a "vicious circle" developed, which was corrected by a subsequent anastomosis between the two legs of the small intestine. In all these operations, as well as in a far larger number of cases of carcinoma, the Murphy button was usually employed, and, with the exception of the case he had already referred to, he had never seen any untoward effects from its use. He could not say the same in regard to its use in entero-enterostomy. He had found it especially serviceable in cases where a rapid operation was indicated. While theoretically the suture method was better, nevertheless, the use of the button should not be neglected, and the surgeon should be able promptly to resort to it in cases where it was indicated.

DR. CHARLES L. SCUDDER, of Boston, said the results of the operations presented in this series of stomach cases are very satisfactory. Cases of carcinoma of the stomach are to be grouped into two large classes: first, those which, in the absence of adhesions and visible metastases, lend themselves to a partial gastrectomy; and, second, those in which, in view of pyloric stenosis or interference with gastric motility, a gastrojejunostomy is indicated. The perfection of technique and the slight shock attending a partial gastrectomy are suggestive that a partial gastrectomy will be applicable to certain cases which hitherto have been treated by a gastrojejunostomy. In other words, partial gastrectomy may serve as a palliative operation. In certain well selected cases partial gastrectomy will afford a life of greater comfort than that following a gastro-enterostomy. This thought is suggested by the report of the cases shown.

DR. HOWARD LILIENTHAL, in referring to the technique of gastro-enterostomy, said there was one point in connection with the method that he had learned quite by accident, and he had employed it during the past two years with much satisfaction. Briefly, it was this: A hat-pin was inserted through the loop of intestine and another through the stomach at the points where the anastomosis was to be made. The sharp ends of the pins were then buried in small corks, while the heads of the pins were held by an assistant. The posterior walls were then closed by two layers of sutures, the pins removed and the line of union com-

pleted. The needles gave the surgeon an absolutely safe landmark for his incision, and he could feel assured that the deep sutures had included all of the coats, thus insuring absolute hæmostasis.

Dr. Lilienthal said he had recently operated on two cases of congenital pyloric stenosis, one at the age of seven weeks; the other at nine weeks. In both of these he used the hat-pin method. The use of the Murphy button was out of the question, as the small intestine was not larger than an ordinary lead-pencil. The first case made a perfect recovery, and was still alive and well after three months. In the second case, the child's recovery was interrupted by the necessity of a mastoid operation, and died from the added shock.

Dr. GEORGE WOOLSEY referred to a case which was operated on two years ago last summer. There was an indurated mass involving the pylorus, which was supposed to be a carcinoma. A gastro-enterostomy was done, and in the course of time there was a complete disappearance of the mass, which was doubtless an indurated ulcer instead of a new growth.

In speaking of the cases of gastric neurosis reported by Dr. Brewer, Dr. Woolsey mentioned the case of a woman who developed severe gastric symptoms after a curettage. She was treated for several months on the medical side of the Presbyterian Hospital, but the vomiting and emaciation persisted. She was finally transferred to the surgical side, and a gastro-enterostomy was done, but without marked improvement.

Stated Meeting, February 13, 1907.

The President, DR. GEORGE WOOLSEY, in the chair.

THREE LAPAROTOMIES IN AN INFANT.

CHARLES A. ELSBERG presented an infant who was ten months old when he was first seen by Dr. Elsberg on April 30, 1906. Two days prior to that he had swallowed a button. The physician who was called gave the child a dose of castor oil, after which the button was passed, with considerable colic. The cramps persisted and grew worse on the following day. The bowels refused to move, the abdomen became distended and vomiting set in. On the third day of the illness the vomiting became more frequent, the abdomen was tender and much distended, and a tumor was felt in the left iliac region. In addition to this, by bimanual palpation, a mass was felt in the right iliac region.

A diagnosis of intussusception was made, and the abdomen was opened a few hours later. There was considerable free fluid, and an ileocæcal intussusception which extended into the sigmoid flexure. The reduction was exceedingly difficult. The last few inches of the ileum were much swollen, the peritoneal coat was destroyed, and the adhesions so firm that they could hardly be separated. Reduction was finally accomplished, and the abdomen was closed. The bowels moved twelve hours later, and in ten days the child was well.

Four weeks later, Dr. Elsberg was again called to see the patient. He learned that for eight hours the child had been vomiting, the bowels had refused to move, and the abdomen had become distended and tender. As soon as the child could be brought to the hospital, the abdomen was re-opened through the old scar. The ileum was found much distended, and the cæcum was constricted by a band. This was divided between ligatures, the bare surfaces were covered with peritoneum, and the abdomen was closed. Symptoms of shock persisted for twenty-four hours; then faecal matter was passed, and the child's general condition improved. After ten days recovery was complete.

Six weeks later, when the child was just one year old, he was again called to see the patient. There had been, for twenty-

four hours, symptoms of intestinal obstruction. The abdomen was again much distended, and cathartics and high and low enemata had been ineffectual in moving the bowels. The child was vomiting feculent material, which was a very rare symptom in one that age. By bimanual examination, a distended loop of intestine was felt in the umbilical region. The patient was almost in a state of collapse. Again the abdomen was opened through the old scar. The intestines were enormously distended, rendering much manipulation impossible. A band was found which had strangulated a loop of ileum; this was divided between ligatures, and covered with peritoneum. On account of the poor condition of the patient, further manipulations were deemed inadvisable, and the abdomen was closed. The child made an uneventful recovery from this third laparotomy, and had since remained well.

NEPHRECTOMY FOR HYDRONEPHROSIS.

DR. F. TILDEN BROWN presented a woman who had been operated on about three weeks ago, and the chief reason for presenting her was to call attention to the fact that in these cases of hydronephrosis a positive diagnosis could be so readily made by ureteral catheterization tests.

The salient facts of the case were that she had a rapidly growing tumor on the right side, which eventually attained the size of an adult head. A diagnosis of kidney tumor was established by ureteral catheterization, and this was verified upon exposing the kidney through the usual lumbar incision. Upon separating the fatty tissue capsule, an area was exposed where the kidney cortex was so much attenuated that urine escaped. The kidney was thereupon removed, as even a very careful reposition of the organ would not have been a safe procedure.

The woman made an uninterrupted convalescence, and in presenting her Dr. Brown made a plea for a more exhaustive preoperative examination and diagnosis in cases of probable kidney tumors.

CYSTOTOMY FOR LARGE VESICAL CALCULUS NOT DEMONSTRATED BY THE X-RAY.

DR. BROWN presented a man who came under his observation about a year ago. His symptoms indicated the presence of a vesical calculus, and upon cystoscopic examination a large stone

could be both seen and felt. Several very careful radiographic exposures had failed to reveal the presence of the stone in the bladder.

The vesical calculus was removed by suprapubic cystotomy, and the man made an uneventful recovery from the operation. He had some residual urine prior to the operation, and he was still incapable of completely emptying his bladder, although there were no evidences of prostatic enlargement. There was loss of sexual inclination and ability since the removal of the stone. In connection with this feature, the speaker called attention to the fact that Dr. Howard Lilienthal had always maintained that its possible occurrence was an argument in favor of suprapubic prostatectomy instead of the perineal operation.

In reply to a question, Dr. Brown said the stone was composed of urate of soda and uric acid.

DR. ALEXANDER B. JOHNSON said it was in his experience always impossible to detect stones of that composition with the X-rays. Stones containing uric acid or urates merely were, however, rare, and the usual small percentage of oxalate of lime in such stones rendered their detection comparatively easy in most cases; as he had pointed out in a paper published some years ago.

DR. BROWN said that after the removal of the stone from the bladder, Dr. Caldwell had found no difficulty in getting an excellent radiographic picture of it. The composition of the stone was the main reason for the failure of the X-ray to detect it while it was in the bladder.

DR. CHARLES H. PECK said he had had a similar experience with a stone about half the size of the one removed by Dr. Brown. The X-ray pictures in that case were taken by Dr. Cole at Roosevelt Hospital, and failed to show the presence of the stone in the bladder, although the usual landmarks of the pelvis were clearly defined.

DR. WOOLSEY said that he also had had a similar experience in a case of renal calculus, where a stone of considerable size was removed from the pelvis of the kidney subsequent to negative radiographic findings.

LARGE BRANCHED CALCULUS IN EACH KIDNEY.

DR. BROWN presented radiographic pictures, which were taken by Dr. Caldwell, and which showed, in a striking manner,

the presence of a large calculus in each kidney. In reply to a question, Dr. Brown said there were no evidences of infection of the kidney in this case, and the urine was not particularly faulty. The patient had not yet been operated on.

DR. WOOLSEY said he had at present under his observation a case in which a large branched calculus had been removed from one kidney. In that case, both kidneys had become infected, and on that account a nephrectomy was out of the question, although the kidney that had been operated on showed marked evidences of destruction by the suppurative process. The ultimate outcome of the case was only a question of time.

STONE IN THE URETER.

DR. BROWN presented a young man who had been referred to him by Dr. John Rogers. The history of the case dated back for several years, during which period the patient had suffered from repeated attacks of pain in the lower abdomen, which had been pronounced by various physicians whom he had consulted as bilious attacks, or as attacks of appendicitis.

When Dr. Rogers saw the patient, he suspected that the pain might be connected with the kidney, and an X-ray was taken which showed a stone in the ureter just below the sacro-iliac synchondrosis. Palliative treatment was tried for a time without any result. One evening, about three weeks ago, while the patient was on his way home from business, and after two days of very constant pain in the region of the lower ureter, he had a sudden inclination to void urine. While performing the act, there was a sudden, painful stoppage of the flow, followed by the spontaneous discharge of a hard object which was lost. Upon his arrival home, he found that his clothing was blood-stained, and the urethra continued to ooze blood for some time. X-ray pictures taken since that time had been negative, and the natural deduction was that the ureteral calculus had been expelled spontaneously. Dr. Brown said the case was a good illustration of the fact that in dealing with ureteral calculi, we should not rush to operate unless the symptoms were grave and urgent.

DR. JOHN ROGERS said the case was also a good illustration of the fact of how easily a mistaken diagnosis of appendicitis could be made. This patient had consulted at least three members of the New York Surgical Society, and in each instance he was

told without hesitation that he should be operated on for appendicitis. Subsequently, his attending physician in the country detected a little blood in the urine, and this fact, Dr. Rogers said, had induced him to have the X-ray picture taken which revealed the ureteral calculus.

DR. WOOLSEY recalled one case of supposed appendicitis where the presence of blood in the urine led to the suspicion of ureteral calculus. X-ray pictures gave a negative result, but the patient subsequently passed a small uric acid calculus.

SARCOMA OF THE ULNA.

DR. WILLIAM B. COLEY presented a man, twenty-five years old, whose family history was good. On December 8, 1898, Dr. George Tully Vaughan amputated the right arm in the lower third for sarcoma of the ulna. The patient at that time gave a history of having had a "greenstick" fracture of the right ulna three years before, from which he recovered. Two and a half years later, the bone began to enlarge at the site of the fracture, and about three months later it broke at this point, as a result of throwing a stone or cob. Examination at that time (three years after the "greenstick" fracture) showed a spindle-shaped enlargement of the middle of the right forearm, the circumference being $1\frac{1}{2}$ inches larger than the left. The surface temperature was distinctly higher than on the left forearm. The swelling was firm, semi-fluctuating, not tender, except at a point on the border of the ulna where motion and crepitus were felt. A skiagram showed a fracture of the ulna in the middle third and a mass springing from the upper border of the ulna and extending towards the radius. Subsequent exploratory incision showed this mass to be soft, like granulation tissue, attached entirely to the interosseous border and mainly to the upper fragment. A piece was removed for microscopical examination which was made by Drs. Kingdon and Sprague, who pronounced it round-celled sarcoma with a few spindle cells. The patient made a good recovery and remained well until February, 1906, when he noticed an increase in the size of his abdomen, but as he had no pain or discomfort from this swelling, he paid no attention to it. In the early part of October he began to have pain and consulted Dr. J. W. Perkins of Kansas City, Mo., who referred him to Dr. Coley. Physical examination made by Dr. Coley on October

29, showed the patient to be well nourished, having apparently not lost much weight, although he was anæmic. Right arm was absent; there was no local recurrence, nor were there any signs of a return of the disease in the axilla. Examination of the abdomen showed the same markedly protuberant and symmetrically enlarged. Palpation showed the abdomen filled with an enormous tumor, extending from the ensiform cartilage nearly to the symphysis pubis. The intestines are pushed over to the left side. Several large masses, each the size of a child's head, more or less independent from one another, could be made out. They seemed to start in the retroperitoneal glands or omentum. The patient was put upon the mixed toxins of erysipelas and bacillus prodigiosus on November 1, 1906, with little hope of doing him much good, but at the end of one month's treatment the masses in the abdomen had decreased in size so much that the circumference at the umbilicus was 5 inches less than when the toxins were begun. He is still under treatment and has improved very much in general health. He has had the toxins regularly up to the present time, in doses as high as 10 minims, four to five times a week. All the injections have been made in the pectoral region. He has had three intervals of rest, the last period for two weeks. He returned to the hospital yesterday and although he gained 5 pounds while away his tumors are distinctly larger. The tumors have apparently decreased one-half to two-thirds since the beginning of the treatment.

INOPERABLE SPINDLE-CELLED SARCOMA OF THE ABDOMINAL WALL AND PELVIS.

DR. COLEY presented a man aged thirty years. In December, 1892, the patient, then sixteen years of age, was seen in consultation with Dr. L. Bolton Bangs, at the Post-Graduate Hospital. The tumor was 7 by 4 inches in area, extended up nearly to the umbilicus and was deeply attached to the pelvis below and, in Dr. Bangs' opinion, the bladder wall was involved. The tumor was clearly inoperable and was growing rapidly. A section was removed and examined by Dr. H. T. Brooks, the pathologist to the hospital, who pronounced it a spindle-celled sarcoma. The patient was placed in charge of Dr. Coley by Dr. Bangs and was admitted to the New York Cancer Hospital early in February, 1893. The treatment with the mixed toxins of erysipelas and

bacillus prodigiosus was begun at once by local injections into the tumor and kept up for nearly six months. At the end of this time the tumor had entirely disappeared by absorption, without breaking down. The patient was shown before the New York Surgical Society about seven years ago and has since been under occasional observation. He has been in perfect health since he left the hospital nearly fourteen years ago and there has never been any sign of local or general recurrence.

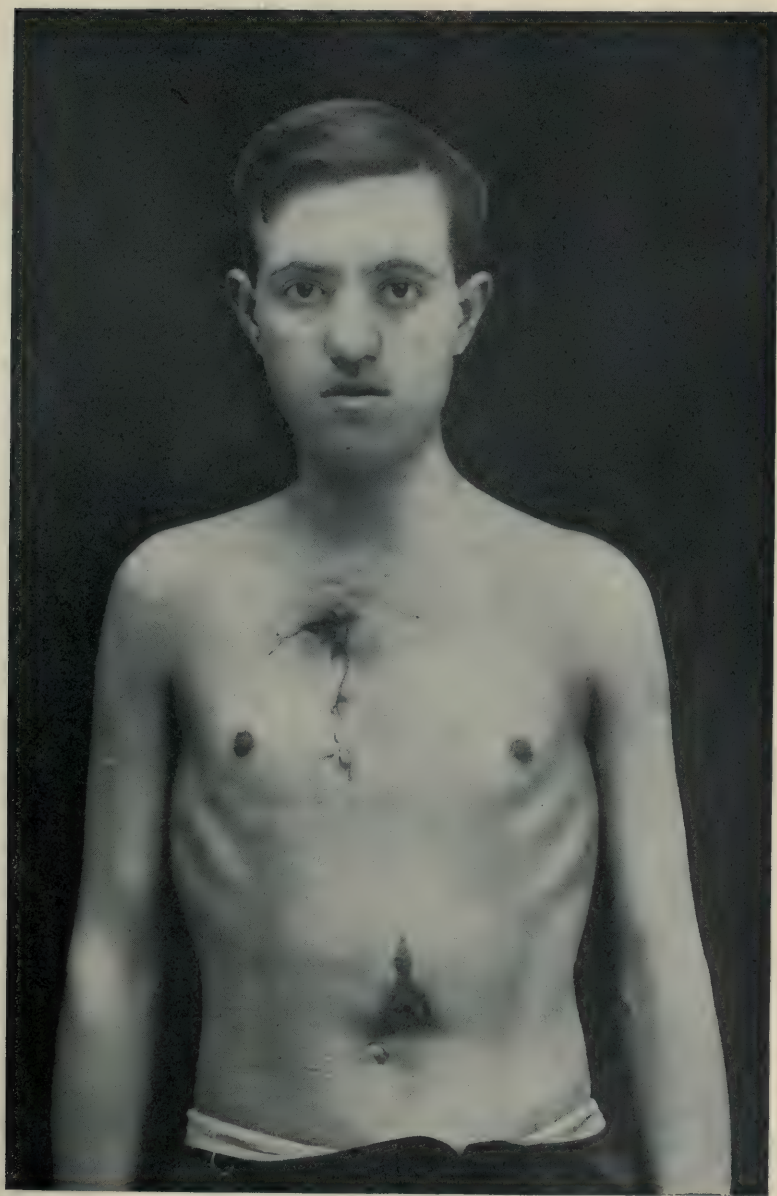
It may of interest to note that seven years ago he had a typical primary lesion of syphilis.

ESOPHAGEAL-THORACIC FISTULA.

DR. WILLIAM A. DOWNES presented a man, aged twenty-two years, whose previous history was negative. In April, 1903, he noticed a swelling on the right side of the chest which gradually attained the size of a small orange. After a week's poulticing it was incised and a quantity of dark-colored foul pus was evacuated. The discharge from this abscess persisted, together with a temperature elevation. The case was regarded as one of tuberculosis of the sternum, and the original incision was enlarged and the wound curetted. The patient improved temporarily, but in the course of six weeks he again applied for treatment, and the wound was again curetted. The wound failed to heal, and the patient was admitted to the General Memorial Hospital on October 15, 1903, and a radical operation for tuberculosis of the sternum was done two weeks later. Through a very large incision, the right half of the sternum was exposed, and a part of the gladiolus and manubrium was excised, together with a part of the 2, 3 and 4 ribs. In the median line there was an old sinus which could not be probed to its full depth.

Four days after this operation an orange pit was expelled through the wound, and from that time on food taken by the mouth escaped through the old sinus. The patient's condition became so poor that a gastrostomy was done on November 15, 1903, and for the following year he was fed regularly through the gastrostomy wound, and in that period he gained about 40 pounds in weight. Recently, Dr. Downes said, the patient had again begun to lose weight. The gastrostomy wound has not been allowed to close, but the patient was feeding himself in the usual way (Fig. 1). There was still, occasionally, a little leak-

FIG. 1.



Dr. Downes' case of oesophageal-thoracic fistula. Photograph taken one year after gastrostomy. Notice low position of opening into stomach, made necessary by enlargement of liver, due probably to congestion.

age of pus through the sinus in the chest wall. The man was up and about, and able to do a moderate amount of work. Pathological examination of tissue removed from the sternum showed no evidence of tuberculosis.

These cases of œsophageal-thoracic fistula, the speaker said, were very rare. When Dr. Osler reported a case in the Johns Hopkins Hospital in 1894 he was able to find only two similar cases on record. Since that time (in 1905) Dr. Alexander B. Johnson had reported one that came under his care in the New York Hospital.

DR. ALEXANDER B. JOHNSON said the patient shown by Dr. Downes had been under his care for some time at the New York Hospital, and he had twice operated on him for the tubercular process involving the sternum, but both operations were prior to the detection of the œsophageal-thoracic fistula.

In connection with this case, Dr. Johnson exhibited a photograph of a case of œsophageal-thoracic fistula that was under his care at the New York Hospital in 1905. The patient was a child with a supposed abscess of the lung, or empyema. A large tuberculous thoracic abscess was found and evacuated, and from that time on the child's food began to be expelled through the wound in the chest wall. In order to feed her, a gastrostomy became necessary. The child improved for a time, but in the course of a few weeks she developed a tubercular peritonitis and gradually failed and died.

DR. DOWNES, in closing, said that the presence of a stricture of the œsophagus was eliminated by the fact that a normal-sized stomach tube could be passed. Upon one occasion, the fistula was filled with bismuth solution, and an X-ray picture was taken in an attempt to locate the opening into the œsophagus, but without any success. There were no indications of stricture, and no history of the patient having swallowed any acid or anything that would have been apt to cause a stricture. The etiological factor in the case had been regarded as a suppurating mediastinal gland, with involvement of the œsophagus, and final rupture. The speaker said he had seen two cases at St. Mary's Hospital for Children where sudden death was due to rupture of a suppurating mediastinal gland into the trachea. In the case he had shown, as well as in the one referred to by Dr. Johnson, the club-shaped condition of the fingers was very marked.

PERFORATING ULCER OF THE STOMACH.

DR. DOWNES presented a woman, thirty-three years old, with a history of ulcer of the stomach of several years' standing. In February, 1906, she was admitted to the General Memorial Hospital, and under appropriate treatment, her gastric symptoms disappeared, so that she was able to return to her home and resume her usual duties. Subsequently, however, her symptoms recurred, and on December 11, 1906, after drinking a glass of vichy and milk, she immediately experienced a violent pain in the epigastrium, and went into moderate collapse. She was seen at that time by Dr. Walton Martin, who regarded the case as one of probable perforated gastric ulcer.

When the patient was admitted to the hospital, she gave no history of vomiting. The abdomen was extremely hard and board-like. Operation seven hours after rupture. Upon opening the abdomen there was an escape of gas and free fluid in the peritoneal cavity. A perforation was found in the anterior wall of the stomach. It was large enough to easily admit the end of the index finger, and surrounded by an indurated area, which it was thought wise to excise freely. The wound, about 3 inches in length, was closed with three rows of sutures, first interrupted inverting and other two continuous; the abdomen was not washed out; a cigarette drain was left. The patient made an excellent recovery, and when she left the hospital on January 17 of the present year, she had gained 11 pounds in weight.

DR. BENJAMIN T. TILTON said that during the past two years he had seen ten cases of perforated gastric ulcer, mostly in men of middle age with an alcoholic history. Dr. Downes' case was the first he had seen in a female, although according to the literature it was more common in women than in men.

DR. CHARLES H. PECK said he had operated upon seven cases of perforated gastric ulcer in the past three years, two of them in women and five in men. In several of the cases, the patients were between twenty and thirty years old. Six of them were acute. He had done one recently in which the perforation was of long standing, with adhesions of the edges of the ulcer to the anterior abdominal wall in the left upper quadrant of the abdomen.

DR. JOHN F. ERDMAN said he had had thirteen cases of per-

forated gastric ulcer, four or five in women. The rest were men. In a recent case that came under his observation the perforation was in the cardiac end of the stomach, which he considered was a rare occurrence.

DR. WOOLSEY said he could recall only one case of perforated gastric ulcer in a male subject, and that was not an acute case, and was complicated by adhesions to the under surface of the liver. He recalled another case of carcinoma in the male, with perforation of the stomach wall. All his other cases had been in females.

GUN-SHOT WOUND OF THE ABDOMEN INVOLVING THE SPLEEN.

DR. GEORGE E. BREWER presented an unmarried woman, twenty-three years old, who was brought to the Roosevelt Hospital in December, 1906, suffering from a gun-shot wound of the abdomen. Upon admission, she was apparently in a moderate degree of shock; her face was pale and the pulse weak, but not particularly accelerated; temperature normal. She complained of severe pain in the left upper quadrant of the abdomen, which was increased on deep inspiration. Examination revealed two bullet wounds, one situated anteriorly, between the eighth and ninth ribs, about 3 inches to the left of the median line; the other on the posterior lateral aspect of the chest at about the level of the tenth intercostal space. As she stated that her assailant stood in front of her, it was probable that the anterior wound was the point of entrance of the bullet.

Examination of the chest was negative. Palpation of the abdomen showed marked rigidity over the entire left side, particularly in the hypochondriac region. Upon opening the abdomen, a fairly large quantity of fluid and clotted blood was found in the peritoneal cavity. As the blood seemed to flow from the region of the spleen, that organ was with considerable difficulty drawn into the abdominal wound. The bullet had evidently penetrated just above the hilum, making a deep groove along the inner surface and free edge. It then penetrated the chest wall, and emerged at the posterior opening. An attempt was made to close the wound in the spleen by mattress sutures, but this failed on account of the friability of the tissues.

As the hæmorrhage was readily controlled by gauze pressure,

a large Mikulicz tampon was introduced, and the spleen pushed back into position. A separate opening was made for the gauze drain, so that in its removal it would not drag the spleen out of place and thus reopen the wound. A hasty examination of the stomach and intestines was made, the abdomen was washed out with salt solution and the wound closed.

The patient made an uneventful recovery. The gauze was allowed to remain in place for ten days, when it was removed without difficulty.

ABSCESS OF LEFT LOBE OF LIVER.

DR. BREWER presented a man, forty years old, who was admitted to the Roosevelt Hospital in September, 1906, in a state of septic intoxication. His mind was clouded, and he could give very little information as to the character of his early illness. He complained of vague pain in the upper part of the left side of the abdomen and thorax, which was increased on deep respiration. His temperature was 103; pulse, 120; leucocytes, 18,000. On examination, there was moderate tenderness in the epigastric and left hypochondriac regions, with some muscular rigidity, and an increased sense of resistance on deep pressure. No definite mass could be felt. On auscultation there was diminished respiration over the lower left back, with entire absence of fremitus and marked dulness over the lower 3 inches of the pulmonary area.

Exploratory puncture of the chest gave no evidence of pleuritic effusion. The pulse and temperature remained high, and the patient became somnolent and delirious. An exploratory incision was made through the middle of the left rectus muscle. Upon opening the peritoneum, it was found that the left lobe of the liver was much enlarged and œdematous, and partly attached to the parietal peritoneum by fibrous adhesions. An exploring needle introduced to the depth of 5 or 6 cm. withdrew creamy pus. The liver was then stitched to the parietal peritoneum, and the external wound packed with gauze. Forty-eight hours later the liver was incised, and about a pint of creamy pus evacuated. The finger introduced between the incisions revealed the fact that the abscess was of the subphrenic variety.

Although considerable relief followed the draining of this abscess, the temperature never dropped to normal, and as the

tenderness also persisted, it seemed evident that the pocket was imperfectly drained or that some other focus was present. The pus cavity was thereupon washed out, with considerable improvement. The discharge diminished, and the wound surface was apparently healthy. The patient's appetite and color also improved, and he said that he felt better, but still complained of pain in the side.

Shortly after this period of improvement, his temperature rapidly rose, and he developed some cough and severe pain on deep inspiration. Examination of the thorax showed a large area of flatness, with absence of respiration and fremitus. Exploratory puncture was negative. He continued to grow worse, and remained for some days in a profound septic state, which was thought to be due to a complicating pneumonia. Later, he had chills, with definite daily remissions of temperature, and sweating. He was again aspirated, and pus was finally reached at a great depth from the surface. Under general anæsthesia, about 3 inches of the ninth rib were resected; the pleura was then opened and the cavity was found to be free from fluid. A needle introduced through the diaphragm, after penetrating a mass of solid tissue, entered a pus cavity and withdrew a quantity of chocolate-colored, foul smelling pus. The diaphragm was sutured to the parietal pleura, and the external wound was packed with gauze. Two days later an incision was made into the liver substance, opening the abscess cavity, and a large quantity of pus evacuated.

A rapid improvement followed the drainage of the abscess, which was apparently situated in the left lobe of the liver, and which could not be demonstrated to have any connection with the anterior abscess cavity. From that time on, the patient's convalescence seemed to be established, although on two or three occasions a retention of the secretion would give rise to a sudden temperature, but these attacks were always relieved by establishing better drainage. The patient's illness extended over a period of four months, and he eventually made a satisfactory recovery.

BLEPHAROPLASTY BY PREGRAFTED FLAP.

DR. C. L. GIBSON showed a woman whom he had operated on two and a half years ago for an epithelioma of the outer third of the lower eyelid. The operation was done in two stages. A horizontal incision through the skin $1\frac{1}{2}$ inches long was made,

starting at the outer canthus. This flap was undermined to a depth of an inch, making a pocket into which was introduced a skin graft with its raw surface looking towards the undermined skin. Three weeks later when the flap had shrunk somewhat and was perfectly lined with its skin graft the flap (Dieffenbach) was completed by two parallel vertical incisions. The whole thickness of the outer half of the eyelid was now excised and the flap swung into the defect.

The result was an admirable imitation of the normal eyelid. The skin graft in its new position quickly took on the qualities of mucous membrane and the flap continues to be non-adherent and with a well defined free edge.

There is now, after two and a half years, a little sagging downward of the flap as a whole, a disadvantage inherent to any flap with tension below, but the free eyelid is perfect in looks and function.

This is a new principle in making new eyelids. To get a perfect result, however, it ought to be applied to some other form of flap free of the disadvantages of the Dieffenbach flap.

PLASTIC OPERATION FOR CONGENITAL HABITUAL DISLOCATION OF PATELLA.

DR. CHARLES A. ELSBERG presented a boy, fourteen years old, whose right patella had been freely movable from birth. When the leg was flexed to any degree, the patella would become dislocated. As the child grew older, this occurrence became more and more common, and practically incapacitated him. When the limb was in an extended condition, the patella was approximately in its normal position, but as soon as the leg was flexed to 45 degrees or beyond, the patella, after becoming fixed on the external condyle, would suddenly be dislocated outwards and backwards so as to lie in the outer part of the popliteal space.

Dr. Elsberg said that various operations had been described in order to remedy this condition of habitual dislocation of the patella, but none of them had given uniformly good results. The condition was supposed to be one to the absence of the prominence of the external condyle, or to a defect of the muscles or tendons on one side or the other. The method described by Krogus, of Sweden, and which Dr. Elsberg followed in this case was this:

The patella is exposed by a long curved skin incision passing downwards from the middle of the thigh to the upper part of the leg. The skin is dissected up from the deeper parts. From the tissue to the inner side of the patella, a long flap is raised, extending from the middle of the thigh to the upper part of the tibia. This flap is made at least 2 inches wide, remains attached above and below, and consists of all the tissues from the fascia down to the synovial membrane of the knee joint. After the flap has been raised, it is sewn into a gap in the tissues to the outer side of the patella, which is made by incising the tissues to the outer side of the knee cap from above downward. The gap left by raising the flap on the inner side is closed by interrupted sutures. By this means the tissues to the outer side of the patella are lengthened, those to the inner side are shortened, and the transplanted fascia, muscle flap aids in preventing a recurrence of the outward dislocation of the patella.

The result obtained in the patient presented was an excellent one. The operation was done ten months ago. Even when the limb is violently flexed to the full extent, the patella remains in its normal relation to the condyles of the femur.

THE LESIONS ASSOCIATED WITH GUN-SHOT WOUNDS OF THE STOMACH.

DR. WALTON MARTIN read a paper with the above title, for which see page 699.

DR. ALEXANDER B. JOHNSON said that in his experience, gun-shot wounds of the stomach uncomplicated by other serious lesions were extremely rare. During a ten years' experience at the Roosevelt Hospital he could only recall one case in which the stomach alone was injured, and that case was peculiar in that the patient had had an adhesive peritonitis, and all that was necessary to do was to open the abdomen and sew up the bullet wound in the stomach. Where the bullet went to in that case, the speaker said he did not know.

In addition to that case, Dr. Johnson said, he could recall only four other cases of gun-shot wound of the stomach upon which he had operated. In two of these, the shot was fired from in front, and the other two from the side or from behind. In one of the latter the lung was injured and in the other the pleura, and in both the diaphragm was perforated. In one of the cases

shot from in front, both walls of the stomach were perforated, as well as the small and large intestines, and the most alarming feature of the case was the profuse hæmorrhage from the division of a considerable branch of the mesenteric artery. This patient recovered. The other three died. In the other case shot from in front, both walls of the stomach were perforated, together with four or five perforations of the small intestine. In addition to that, the patient had shot himself through the head, and died from the effects of the latter wound.

In the two cases shot from the side or posteriorly, the complications were numerous. In one of them the bullet passed through the left lung and diaphragm, both walls of the stomach, the large and small intestines and the kidney. Upon opening the abdomen, the injured lung immediately collapsed, and the patient was in very bad condition. The wounds in the stomach and intestines were closed, but that in the kidney was overlooked and proved fatal.

In another case where the diaphragm was also perforated, collapse of the lung took place. In addition to the injuries in the thorax, the bullet passed through the spleen, through both walls of the stomach, through the large and small intestines and into the liver, where it was found at autopsy. This patient died four or five days after receiving his injury, the immediate cause of death being a generalized infection from the bacillus *aërogenes capsulatus*.

In all these cases, Dr. Johnson said, the wounds in the stomach were practically a small matter as compared with the complications that were met with. In those cases where the diaphragm was wounded, with resulting collapse of the lung, that in itself was a very serious factor, and the patient's condition at once became very grave not only from the loss of lung power on that side, but also from the probability of infection of the pleura and the production of empyema.

In the treatment of wounds of the diaphragm, the speaker said he had not been able in his cases to reach them with sutures, although he had tried to do so. In the cases he had met with, an osteoplastic operation on the thorax was out of the question, as the condition of the patients was such that a rapid completion of the operation was imperative.

DR. JOSEPH A. BLAKE said that in gun-shot wounds of the

stomach associated with injuries of the diaphragm and thorax, one of the chief points of interest was in connection with the question of whether it was advisable to do a thoracotomy at the time of the primary operation. He recalled one case of gun-shot wound involving the thorax and diaphragm, the stomach, and the left lobe of the liver, where the patient did well as far as the abdominal condition was concerned, but died of pyopneumothorax. This was in accord with the general experience that these patients died as the result of the thoracic complications rather than the abdominal. In one of the cases reported by Dr. Martin, where a thoracotomy was done at the time of the primary operation on the stomach, the former was probably largely instrumental in saving the patient's life. Dr. Blake said that in one case of shot-wound passing through the humerus, two ribs, the diaphragm and the stomach, he first opened the thorax and sewed the diaphragm to the thoracic wall, and then drained the stomach wound through the thoracotomy wound. The patient died within a few hours after the operation.

DR. JOHN F. ERDMAN, in reply to Dr. Blake's query as to the advisability of doing a thoracotomy at the time of the primary operation on the stomach, referred to a paper by Dr. John Young Brown of St. Louis, which was read before the American Gynecological and Obstetrical Society at Cincinnati in September, 1906, in which he reported a series of cases of stab and gun-shot wounds with several recoveries, and in all of these cases he had done a thoracotomy.

DR. WOOLSEY referred to a recent case of gun-shot wound of the stomach involving the thorax. The stomach was perforated anteriorly and posteriorly, near the lesser curvature; these openings were closed, and nothing was done to the wound in the thorax. The patient did fairly well for eight days, when the wound accidentally became infected and death occurred two days later.

In another case of gun-shot wound of the stomach with a number of perforations of the intestine, which Dr. Woolsey said he reported some years ago, the perforations were closed, and the patient made a good recovery. In that case none of the abdominal viscera were injured.

DR. MARTIN, in closing, said that in most of the cases of recovery after operations for injuries of the diaphragm that had

been reported the injuries were due to stab wounds and not to gun-shot wounds. Suture of the stomach wall through the thoracic wound after stab wound injuries had been done a number of times, but not after gun-shot wounds. In one case reported by Zawadzki, he resorted to a primary thoracotomy, reduced the prolapsed omentum, sewed up the wound in the diaphragm, and then sutured the wound in the stomach through an abdominal incision. The patient survived the operation about eighteen hours. In dealing with perforations of the stomach by small bullets, Dr. Martin said he did not think the wounds were entitled to the significance that was formerly attached to them, the gravity of the injury depending on the associated lesions.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, February 4, 1907.

The President, DR. JOHN B. ROBERTS, in the Chair.

ENDOTHELIOMA OF THE PALATE.

DR. JOHN H. GIBBON presented a man, aged 26 years, who was admitted to the Pennsylvania Hospital on January 4, 1907. He stated that he first noticed a swelling on the left side of the roof of the mouth five years previous. This has gradually increased until there was a large tense apparently fluctuating mass extending over about one-half the hard palate and all of the soft palate on the left side. The entire tonsil and left side of the pharyngeal wall was hid by the growth, which extended down nearly to the base of the tongue. It interfered with the patient's eating, and when ether was given him interfered very greatly with his taking the anæsthetic. The mass appeared to be cystic. At one or two points there was a suspicious hard area. Because of the duration of the growth, however, and its apparently cystic character it was not thought to be malignant. The blood vessels over it stood out very clearly. There was no obstruction of the nares and no apparent involvement of the pharynx, as the finger could be passed easily behind the growth. After the patient was anæsthetized the tongue had to be drawn forward and pressed down with a tongue depressor in order that he could breathe. He was placed in the Rose position and an incision made over the prominent part of the growth. A quantity of material immediately escaped from the mass, which seemed to be undoubtedly sarcomatous. Practically all of the growth was shelled out with the finger. The hard palate was rough, as if its periosteum had been destroyed. Neither the hard nor the soft palate were perforated

by the growth. Bleeding at this time was very profuse but was controlled by gauze packing and digital pressure. The case seemed a perfectly hopeless one and a prompt and rapid recurrence was expected. The pathologist also on inspection of the material-removed thought it was sarcomatous, but on later thorough examination pronounced it to be an endothelioma. This diagnosis has been fully borne out by the subsequent course of the case. The packing was gradually removed, and although a small cavity still exists most of the induration has disappeared and the patient is entirely comfortable.

Dr. Gibbon is not sure that he removed all of the growth, but upon the slightest evidence of a recurrence he is prepared to again operate and freely remove it. He thinks that an endothelioma in this situation is rather rare. The most frequent site of such growth is the parotid gland. Many of the early cases reported of cure by excision of sarcoma of the parotid were undoubtedly cases of endothelioma.

Dr. J. T. RUGH said that some years ago a boy of 18, from Delaware, came to the Jefferson Hospital with a growth in the posterior nares of the right side. It appeared to be fibrous and was removed by means of a wire snare, removal being followed by almost fatal hæmorrhage. The growth recurred and was then diagnosed sarcoma. A second operation, however, resulted in complete cure. No pathologic report on the tumor was obtained, but as it did not recur a second time it was regarded as an endothelioma.

Dr. JOHN B. ROBERTS described a case of endothelioma of the left nares, which was partially scooped out, and the patient then treated by the X-rays and by the injection of the toxins of erysipelas and prodigiosus. The tumor seemed to be lessened by this treatment. The patient later went to another Philadelphia hospital and was operated upon, it was stated after the principle of Dawbarn, attempts being made to plug the carotid and its branches with paraffin. Dr. Roberts had heard indirectly that the man died later of secondary hæmorrhage.

Dr. W. M. L. COPLIN said that a few years ago he had the opportunity of presenting to the Association of American Pathologists a paper on endothelioma in which he collated all the cases that had been carefully studied—approximately 150. The great mass of these tumors involve the serosæ, particularly the meninges

and pleuræ. Several observers have found similar tumors in the ovary, and a number of papers contain reports of endothelioma of the parotid, this being the basis of most of the so-called mixed tumors of that gland. The paper by Kelly is one of the best English productions on this subject; Borst, in his classic work on tumors, has made an exhaustive study of these tumors. They are interesting to the pathologist because of their histogenesis and peculiar position as to malignancy. In this respect they bear the same relation to other tumors of the sarcoma group as does the flat-celled cancer to the more malignant epithelial neoplasms. They extend along the lymph channels usually without the detachment and transportation of cells seen in the more malignant tumors. During the routine examination of tumors at the Jefferson laboratories some unusual specimens have been seen. Among these are endotheliomata involving the fissural regions of the face. It is probable that many tumors regarded as originating in the antrum or other sinuses are really endotheliomata of the fissures of this region. A few endotheliomata of the mammary gland have also been observed, the diagnosis being confirmed by the subsequent relative benignancy after complete excision. Endothelioma of bone is less frequent than it is in other tissues. Here the tumor bears a striking resemblance to cancer, especially the flat-celled type, but the structure and location indicate the origin from endothelial elements. Vörstmann suggested the classification into hemangio- and lymphangio-endothelioma, but we find groups of cases not properly classified as either—for example, those originating in serosæ, commonly the pleura or meninges, less frequently the peritoneum. The histogenic study of these tumors arising in the ovary, indicate their origin from the endothelial investment of the marginal genetic layers or connective tissue stroma of the organ.

RESECTION OF ILEOCÆCAL COIL FOR TUBERCULOSIS.

DR. JOHN H. GIBBON presented a negro, aged 40 years, upon whom he had operated in September, 1905, for tuberculosis of the ileum and mesenteric glands, resecting a portion of the ileum and cæcum. Two subsequent intestinal anastomoses were done.

The patient was admitted to the Pennsylvania Hospital in September, 1905. He stated that he had lost weight and had suffered from abdominal pain and indigestion for about seven months.

The pain complained of was a general pain in the lower half of the abdomen which seemed from the description to be peristaltic. He was watched carefully for two weeks, a test meal being given and the stomach contents carefully examined. He vomited once or twice during this period, but was able to take full diet without much difficulty. His abdomen was always scaphoid and somewhat rigid. On two occasions a distinct movable mass could be felt in the right iliac region. This was thought to be an enlarged mesenteric gland. There was no fever at any time, and no blood or mucus was passed in the bowel movements. Rectal examination showed some tenderness behind the bladder. No tuberculous lesion of the lung could be discovered. After observing the patient for some time it was finally concluded that he must have some tubercular intraperitoneal lesion, and it was thought that an exploratory operation was justifiable.

The abdomen was opened through the right rectus, and the ileum near its distal extremity was at once encountered. It showed two marked constrictions with a dilated portion of bowel between them, containing a large number of small bodies which felt not unlike gall-stones. These proved subsequently to be watermelon seeds. The patient stated afterwards that he had not eaten a watermelon for over a year. Numerous tubercles were found over the constricted portion of the ileum, and there was a mass of large mesenteric glands behind the ileocæcal juncture. Some of these were as large as hickory nuts. Small tubercles were found in other portions of the peritoneal coat of the bowel. There was no evidence of any tuberculous lesion elsewhere, and there was but a small amount of fluid in the cavity. The bowel was excised from a point some distance proximal to the first stricture to a point above the cæcum. This portion of bowel was removed with its mesentery containing a large number of glands. Other individual glands were then removed. Certainly all the diseased bowel, and apparently all of the involved glands were removed. The open ends of the bowel were then inverted and a lateral anastomosis made between the ileum and the ascending colon. Catgut and celluloid thread were used in making the anastomosis. A gauze drain was inserted down to the inverted ends of the bowel, but not to the point of anastomosis. The operation was a very long one, occupying two hours; this was partly due to the

fact that after dividing the ileum and inverting the end it was found that in order to remove all the enlarged glands a higher division of the bowel would be required. The patient made a very satisfactory recovery after his operation, but on the fourth day he had considerable pain and vomited. Chloride of ethyl was administered, the gauze drain was removed, and there was an escape of considerable gas and some liquid fæcal matter. There was no other interference with convalescence but the fæcal fistula did not close, although the discharge grew much less.

The patient was readmitted to the hospital on January 14, 1906, complaining of painful peristalsis and with the fæcal fistula still open, although discharging but a small amount of fæcal matter. The peristaltic movement of the bowel could be distinctly observed through the abdominal wall, the bowel becoming greatly distended in the right iliac region near the wound. With the idea of removing whatever caused the obstruction to the small intestine, and of closing the fæcal fistula, the abdomen was opened on the outer side of the old scar. The adhesions were very extensive and it was discovered that the fistula opened probably at the point of anastomosis. The proximal portion of the ileum was enormously distended and hypertrophied. This extended up the ileum for probably two or three feet; the colon was quite collapsed. As the intestines were so matted together it was thought wise to make a new anastomosis between the ileum and the transverse colon. This was done without cutting off the ileum at the site of the previous anastomosis. The fistulous opening into the bowel was closed with sutures, but a drain introduced down to this point. The new anastomosis was surrounded by omentum and the abdomen closed, excepting at the point of drainage. The patient made a good recovery from this operation but the fæcal fistula continued to discharge.

He was operated upon again in March, 1906, by Dr. Le Conte, and an attempt made to close the fistula. This was not, however, successful, and a few months later the discharge was greater than it had ever been, although there was no longer any painful peristalsis.

The patient was again seen by Dr. Gibbon in December, 1906. He had gained 18 pounds and was able to do light work. He was greatly troubled, however, with the discharge of fæcal matter, and he was again admitted to the hospital. On January 11, 1907,

Dr. Gibbon opened the abdomen through the left rectus, with the idea of dividing the ileum at the point of anastomosis to the transverse colon and anastomosing it with the sigmoid. The abdominal cavity was found in good condition excepting for numerous small tubercles over the bowel and mesentery; there was no fluid and there were no enlarged glands. The last anastomosis was in good condition and apparently working satisfactorily. There was no distention of the bowel. The ileum was divided near the anastomosis, the two ends inverted, and the proximal one anastomosed laterally to the upper portion of the sigmoid. The abdomen was closed without drainage and without any attempt being made to close the fistula on the opposite side.

Since this operation the patient has progressed very satisfactorily. At first there was a free discharge of faecal matter from the old fistula, but this stopped after a few days. The fistula was Y-shaped, having two external openings, and one of these closed over firmly after the operation, but the other is still discharging a small amount of mucus and pus. The patient's temperature is normal and he is able to move about and is quite comfortable.

The specimen removed at the original operation was exhibited. It is 38 cm. long, 34 cm. of ileum and 4 cm. of cæcum., The mesentery is attached to the intestine and contains a number of enlarged glands. There are two constrictions, one of 5 cm. from the ileocæcal juncture and the other 13 cm. above this one. The bowel between the two constrictions is very much distended and thickened; in this distended portion between the strictures there was found, when the specimen was examined, two or three ounces of watermelon seeds with one grape seed. The peritoneal covering of the bowel and mesentery is studded with small tubercles and numerous hard bodies can be felt in the intestinal wall. The mesentery is very thick and contains a number of large glands, the largest measuring 4 x 3.5 x 2 cm. These glands on section proved to be caseous. The appendix is tightly bound down to the cæcum by adhesions. The lower stricture is 3 cm. in length and the lumen of the bowel at this point .5 cm. The second stricture is 1 cm. in length and the lumen of the bowel 1.5 cm. The pathological diagnosis was tuberculosis of the intestine with chronic ulceration; tuberculosis of the mesenteric glands; and hypertrophy of the muscular wall of the intestine.

Dr. Gibbon stated that this case and another in which he had resected the colon from the hepatic flexure to the middle of the sigmoid and made a successful end-to-end anastomosis for tuberculosis, caused him to feel that patients afflicted with tuberculosis of the intestine stood extensive operation well, and that there was a chance for even the most apparently hopeless of these cases. The second case referred to was operated upon March 5, 1905, and is perfectly well at the present time. In this case an end-to-end anastomosis was made and a fæcal fistula persisted for some weeks, but finally closed. It is thought that a lateral anastomosis is better in resections of the large intestine than the end-to-end.

HÆMOPHILIC KNEE-JOINT; OPERATION; CONTROL OF HÆMORRHAGE BY USE OF THYROID EXTRACT.

DR. J. T. RUGH, by invitation, reported this case and presented the patient. For description and remarks upon this case, see page 666.

DR. WILLIAM J. TAYLOR said Dr. Rugh's results in this case confirmed his observations regarding the control of hæmorrhage, though he has had no experience with joints. The use of thyroid extract diminishes the coagulation time of the blood, though as yet we do not understand its action. In these cases two conditions must be considered: first, the coagulation time of the blood; second, the condition of the tissues. Dr. Sajous advances the theory that the pituitary body governs the adrenals and that coagulability is kept up by the thyroid stimulating the pituitary. This has a practical value when the coagulation time is lengthened, as in some cases of jaundice. In a number of the latter the time is not lengthened, hence thyroid extract will in them have no value. Murphy and Gould in a study of fifteen cases of jaundice from all causes—cancer, obstruction, etc.—did not find in one a change in the coagulation time. In one case of obstructive jaundice from malignant disease, under the care of Dr. Harte, the coagulation time was lengthened. Wiel has used for this condition injections of beef soup, practically bouillon, into the veins with good results. Dr. Taylor is confident regarding the value of thyroid extract when the coagulation time is lengthened. In one case its administration for a few days brought the time down from thirteen minutes to two minutes and six seconds. The individual making the test must be taken into account, as methods for deter-

mining the coagulation time are not well worked out. There are sources of error in Wright's instrument. In another appliance the blood is kept in motion by a current of air. A practical method is to place a drop of blood on a slide and determine by position of the latter when coagulation has occurred. The personal equation is great and all the tests should be made by one man. The subject is one that should be investigated more carefully. Dr. Taylor now uses thyroid extract whenever bleeding is a probability. He has employed it in operations upon the kidney, bone, for the extraction of teeth and in the case of removing glands of the neck from a boy whose grandfather was a terrific bleeder. In the last case the coagulation time was lowered from eight to three minutes in forty-eight hours and the operation site was perfectly dry.

DR. W. M. L. COPLIN said we know something of the basis of thyroid therapy in cases of hæmophilia. Women escape the affection, hence we look for organs in the female which possibly by an internal secretion combat any tendency to this diathesis. For such organotherapy ovarian extract has been suggested and in some cases has been of value. Hyperthyroidism is more common in the female, the relation between the thyroid metabolism and the general economy being more intimate in this sex. This is shown by the changes in the gland during menstruation and gestation; its relation to myxœdema and exophthalmic goitre is well known. If we are correct in the assumption that activity of the thyroid and parathyroid glands enable the female to escape hæmophilia, the basis of employing thyroid extract to counteract the manifestations of the disease becomes plain. Dr. Taylor referred to the exact cause of hæmophilia. Of the two theories, Dr. Coplin's inclination is toward the histogenous, the hæmatogenous not appealing to him as possessing a sound basis. There is no specific relation between coagulation time of the blood and hæmophilia, the relation being the same as in any anæmia. This diminished coagulability was shown at autopsy upon a case of pernicious anæmia in which the blood clotted in a basin some time after it had been removed from the body, yet there is no necessary relation between secondary anæmia and bleeding. Loeb's studies concerning the relation between tissue juices and the blood indicate that in coagulation there is necessary a certain element which is supplied by the tissues. He suggested as the source of this

element the endothelium of the capillaries. Such element is not supplied when metabolism is deficient, and on this basis may be explained the occurrence of periods when hæmophiliacs are not hæmophiliacs,—that is, when they do not bleed excessively. Wright's studies on the calcium content of the blood show that the explanation based upon its lowered quantity applies in some cases; in others the calcium is entirely within the normal limits, and therefore this cannot be the cause of the condition.

Dr. Rugh's case is an instance of the cryptogenic or latent type of hæmophilia. These cases are well known, there being at least the gastric, intestinal, biliary, arthritic, and renal types; possibly there is a meningeal form. In the renal type the kidney may show no microscopic lesion though hæmorrhage had been severe. It is also to be remembered that paranephric hæmorrhage may follow trifling injuries. König, Broca, and also Poillet, have studied particularly the joint manifestations of hæmophilia, Poillet analyzing 252 cases. In about 50 per cent. of cases the knee is involved and in 25 per cent. the elbow. In none of Poillet's cases was the operative result so good as in Dr. Rugh's case. None was diagnosed before operation. The findings in these joints were well described by Dr. Rugh. Chondroid erosion is marked, in some instances this process extending even into the marrow. Spongy articular cartilages are produced in some cases. Lipping of the articular cartilages at their margins is more marked in operative cases and may become so prominent as to lead to fixation of the joint. This is due to chondroplastic proliferation of the marginal genetic layers of the cartilages, hyperplasia of the serosa not being anatomically important in the locking. These joint lesions are not the result of primary changes in the bone. There has been reported an instance of hæmophilia with separation of the epiphysis due to hæmorrhage between the epiphysis and shaft, with resulting formation of a flail joint. Dr. Rugh's case illustrates the muscular wasting which often accompanies the joint lesion. This remains unexplained, as it is not a question of fixation as in tuberculosis. Sometimes even the tendons wither. This wasting suggests in a way the exploded theory of the neurogenous origin of hæmophilia. A practical point regarding these cases is the almost certain recrudescence of the hæmophilic lesion. The age of Dr. Rugh's patient is against this, as the great majority of cases occur in boys of from four to six. A diagnostic

point in hæmophilic hæmarthrosis is para-articular hæmorrhage. This is sometimes shown as a faint hazy bluing of the sulcus on each side of the patella. At times distinct hæmorrhage is present. This ought to constitute an important diagnostic feature.

PLASTIC RECONSTRUCTION OF THE EYE-BROW AND UPPER EYE-LID FROM THE TISSUES OF THE SCALP.

DR. JOHN B. ROBERTS reported this case with presentation of the patent. The child had a large arteriovenous angioma of the forehead and upper eye-lid, which he treated successfully by strangulation, excision, injection of boiling water and other methods. Its removal left the eye-ball exposed and a corneal ulcer developed. A pedunculated flap from the scalp was brought down to make the upper lid. Subsequently this was split horizontally and the hairy part transferred to the superciliary region to make the eye-brow. Later a portion of this soft hair will be shaved to cause it to become coarser, and probably some of the superfluous hair will be removed by the electric needle.

EXCISION OF BRANCHIAL FISTULA.

DR. JAMES W. MACINTOSH presented a boy of twelve years. A small opening in the skin at the lower and inner border of the right sternomastoid muscle was noticed when the boy was two weeks old. This had remained open and discharged mucus except for a period of one and one-half years some time between the age of two and five. From the location of the opening and the fact that it was congenital a diagnosis of branchial fistula was made. Through the fistula a solution of quassia could be injected into the mouth, proof that the fistula was complete. A silkworm gut suture was at first inserted and finally a small lachrymal probe was passed. This enabled dissection and removal of the entire tube. The inner end was pulled down and a chromicized catgut ligature applied. Before it was tightened the ligature was carried to the pharyngeal wall by means of two pairs of curved hæmostats and a second knot then made. The stump was then twisted four times and allowed to retract. The lower end of the external wound is not yet healed because of the eczematous condition of the skin caused by the discharge from the fistula.

DR. JOHN H. GIBBON remarked on the difficulty with which these fistulæ are excised. He never before saw one removed so

entirely as was the specimen shown. Only time will tell if the cure is permanent. Surgeons often feel that the fistula has been completely removed and yet it reforms. If a slight amount of the mucous lining be left, recurrence will follow.

DR. W. W. KEEN regards the use of quassia as an ingenious plan well worthy of repetition in future cases of such fistulæ. He agrees with previous speakers as to the difficulty of excising the fistulous tract in its entirety. Branchial fistulæ are rare, the similar condition of the thyroglossal duct being more common. The latter he has almost never succeeded in curing by one operation.

INTRALOBULAR ABSCESS OF LUNG.

DR. CHARLES F. NASSAU presented a man, aged thirty-eight years, who was first seen by him, with Dr. M. T. Prendergast, October 7, 1906. He had then been ill for ten weeks. The patient was dreadfully emaciated, extremely weak, with a rapid pulse, in the neighborhood of 120 per minute. He had very little cough and that was of a hard brassy character. There was constant pain at the base of the right lung. Puncture of the chest made in the mid-axillary line in the fifth interspace and in three different directions revealed no fluid of any kind.

October 19, 1906, he was seen again in consultation with Dr. Prendergast and Dr. Alfred Stengel at St. Joseph's Hospital. A preliminary puncture through the fourth interspace gave vent to abundant pus. About 3 inches of the fourth rib was then excised and through the adherent layers of the pleura an intralobular abscess of the upper lobe of the lung was broken into, evacuating somewhat less than a pint of pus. Light general anæsthesia by ethyl chloride, the patient almost dying on the table.

Following this operation the wound did very well, the walls of the abscess collapsed rapidly and the temperature fell immediately to normal. The patient was discharged from the hospital on November 13, 1906. The wound at this time was entirely superficial. The patient continued to do well for one week at his home, when he had a chill followed by high fever, sweating and general prostration. On November 23, 1906, after a second consultation with Dr. Prendergast and Dr. Stengel, it was determined that he probably had an empyema below the site of the previous incision into the lung, so a second operation was done, con-

sisting in still further excision of the rib previously operated upon, together with a wide excision of the rib below. About two pints of bad smelling bloody fluid, with here and there streaks of pus, was evacuated. In addition to the above the site of the primary operation, two encysted abscesses were encountered and evacuated. The patient's condition was so desperate that in order to give some support to the violent and wide excursions of the partially collapsed lung, a large quantity, about 7 square yards, of gauze was rapidly packed through the wound on the side of the chest. The patient's pulse at this stage was scarcely perceptible, his pupils were widely dilated, lips were purple, respirations could not be counted, his hands, feet and nose were cold. However, sufficient hypodermatic injections of camphorated oil began to bring about reaction. At the end of twenty-four hours one could say that they hoped he would recover.

From this time on convalescence was uninterrupted, although after the removal of the gauze packing introduced at the time of operation one could almost thrust one's whole hand into the patient's pleural cavity. Now the wound has entirely healed except a small granulating area in the skin, hardly an inch in length and less than a quarter of an inch in width. The lung has descended almost to its normal level and the breath sounds on the right side of the chest are quite normal.

RUPTURE OF KIDNEY AND LIVER.

DR. CHARLES F. NASSAU reported the following case: A man was admitted to the Frankford Hospital, October 27, 1906, with a history of having been kicked in the right side along the lower margin of the ribs by a horse. When first admitted he was in a state of shock, with rapid shallow respiration which was largely due to the fracture of four ribs on the right side. His temperature, which on admission was subnormal, reacted and rose rapidly. His pulse on admission, while rapid, was of good tension. There were no external marks of violence. The abdominal muscles were rigid, particularly on the right side.

The resident within an hour after his admission noted increasing power with a rapidly rising pulse rate and temperature. Respiration also became more shallow and of a slight sighing type. When seen by the reporter, about three hours after the injury, there was distinct dulness in the right flank. He passed

bloody urine, and on account of his increasing weakness since admission an internal hæmorrhage due to injury of the kidney was suspected. He was immediately etherized and prepared for operation on the table.

An incision was made along the right costal margin, beginning at a point about three inches to the right of the median line and ending well out in the right loin. As the peritoneum was approached it seemed to be infiltrated with blood, in fact so disorganized as to hardly require incision. Blood welled up rapidly out of the abdominal cavity and, as the intestines upon superficial examination seemed to be uninjured, they were packed out of the way and the region of the kidney exposed. The right kidney was found torn practically entirely in half. The whole organ lay free in the abdominal cavity, the peritoneal covering over the kidney not being recognizable. The hæmorrhage was furious. As quickly as possible the renal vessels were clamped and the kidney cut away.

After ligation of the renal pedicle blood continued to ooze from the direction of the liver. Investigation discovered a tear in the liver substance on the posterior edge, extending well up towards the vault of the diaphragm. This was firmly packed and the abdominal wound was then closed except for a point of generous gauze drainage. The man was put back to bed apparently very little worse off for the operative procedure.

During the first 24 hours he passed 15 ounces of urine. Day by day the kidney secretion increased, the urine being quite normal, until on the fourth day he passed 36 ounces of urine. On the fourth day his temperature shot up, he developed an annoying cough and examination of the right lung disclosed a wide spread pneumonia. He died in about three days after the development of the lung condition.

This man at no time had any symptoms that would lead one to suspect a peritonitis; his bowels moved naturally and post-mortem the peritoneal cavity was found well sealed off and appeared to be quite free from any evidence of inflammation.

STAB WOUNDS OF THE HEART.

DR. RICHARD H. HARTE read a paper with the above title for which see page 672.

DR. JOHN H. GIBBON said the fact that Dr. Harte's patient

lived twenty-three days is an instance of what can be done in wounds of the auricle. Heretofore it has been thought by many that a wound of the auricle was necessarily fatal. This case is only another to show that a patient may recover from a stab wound of the auricle. Infection occurred here and proved fatal, as happens in many cases of heart wound.

DR. JOHN B. ROBERTS mentioned a case, which he previously had reported to the College of Physicians, of a suicidal wound of the heart, in which that organ was not perforated. He had not sutured the wound, but had been able to examine with his fingers the exposed heart. The patient died in twelve or fourteen days from infection, there being pleurisy on the left side and pneumonia of the opposite lung.

SEVERE BURN ON TOP OF HEAD AT SEVEN MONTHS OF
AGE FOLLOWED BY NECROSIS OF ENTIRE
OSSEOUS CAP OF CRANIUM.

DR. KEEN read a paper with the above title, for which see page 641.

REVIEWS OF BOOKS.

TUMORS OF THE CEREBRUM. By CHARLES K. MILLS; CHARLES H. FRAZIER and others. Octavo, 1906. Philadelphia: Edward Pennock.

This little book is composed of a number of reprints—seven in all—of articles written by Drs. Mills, Frazier, Spiller, de Schweinitz and Weisenburg, all of Philadelphia. In the first, Dr. Mills discusses the focal diagnosis of operable tumors of the cerebrum, and discusses with painstaking care the groups of symptoms upon which the localization of tumors of the cerebrum depends. The critical reader cannot help the conclusion, however, that in a large proportion of these cases a very considerable uncertainty must always attend their focal diagnosis. In the second, Dr. Frazier discusses the surgical aspects of operable tumors of the cerebrum; the paper having been prepared as a sequel to the preceding paper of Dr. Mills. The author is in the habit of making an osteoplastic cranial flap of from $3\frac{1}{2}$ to 4 inches in width; small openings are first made at suitable points with a burr or chisel, and the intervening line of bone is divided—preferably by Cryer's spiral osteotome. The author describes with sufficient fulness various other models of craniotomes, but prefers the instrument of Cryer because, as he says, "with it but one preliminary opening in the skull is required, and that a small one; and thence a flap can be fashioned of any dimensions, with straight or curved margins, as the occasion demands, and that the cutting of the flap is accomplished more quickly than by any other method." In the third paper, which is by Drs. Spiller and Frazier, 14 cases of tumor of the brain are studied which were subjected to palliative operation by removal of a portion of the overlying skull cap; to this procedure, the term "cerebral decompression" is given by the authors. Dr. de Schweinitz discusses the ocular symptoms of tumor of the cerebrum. Dr. Weisenburg, conjugate deviation of the eyes and head, and disorders of associated ocular movements. Dr. Mills, in another paper, returns to the subject of the focal diagnosis of cerebral tumors with relation to the significance of Jacksonian epilepsy in their study; and in the final paper, Drs.

Mills and Frazier discuss the motor area of the human cerebrum and the surgery of its area. The entire assemblage of papers makes a monograph of great value to both the neurologist and the practical surgeon who may desire to deal with tumors of the cerebrum.

LEWIS S. PILCHER.

DISEASES OF THE NERVOUS SYSTEM RESULTING FROM ACCIDENT AND INJURY. By PEARCE BAILEY, A.M., M.D., Clinical Lecturer in Neurology, Columbia University, New York City; Consulting Neurologist to the Roosevelt, St. Luke's and Manhattan State Hospitals, etc. New York and London: D. Appleton and Company.

With the enormous increase in industrial activity made necessary by mechanical means of productivity, a stupendous increase in the amount of human injury has taken place. While physical violence has been a constant cause for injury from time immemorial it has only been within the past twenty-five years that the effects of traumata on the nervous system have been made the subjects of a more complete and comprehensive analysis. Dr. Bailey's work represents the latest systematic treatise devoted to this general subject.

In a previous work by the same author the so-called "traumatic neuroses" received an almost exclusive attention, but in the present work of 627 pages we have presented a treatise on all the traumatic affections of the nervous system viewed from the standpoint of the neurologist, and dealing with clinical, diagnostic, and therapeutic data.

In a short introduction the general features of the relations of trauma to the nervous system are clearly considered, traumatic in the sense used meaning for the author "quickly acting physical violence or psychic shock which arises outside the body." We also find here a short discussion of what is to be considered functional and what organic, in which the author shows the tendencies of modern biological teachings. In this introduction are also included the general methods of examination of the patient with reference to accident, predisposing features of nervous disease, and some remarks on the examination of the actual injury.

The main body of the book is treated in three parts. Part I deals with the Organic Effects of Injury to the Nervous System; Part II with Functional Effects of Injury; and Part III with

Medico-Legal Considerations. In Part I, four chapters are devoted to injuries to the brain, their complications, and their physical and mental results; three chapters to injuries to the spinal cord; one to the peripheral nerves; and one to trauma as a factor in the causation of certain degeneration diseases. The medical and legal importance of these chapters can hardly be overestimated. The author is singularly concise and straightforward in his account, and little of importance is omitted. A particularly valuable discussion is the one on prognosis following fracture of the skull, especially of the bones at the base. In at least one-half the cases a fatal result is to be looked for, the majority of deaths being due to the direct results of the injury. 95 per cent. of the patients who die from fracture of the base do so within five days of the receipt of the injury. Those who die later die of pneumonia or more rarely of meningitis. Patients who do not die usually recover with reasonable promptness. Bailey calls attention to certain grave symptoms in the prognosis, namely: profound and persistent coma, active delirium, high fever, rapid pulse and respiration which usually foreshadow a fatal outcome. Polyplegia is regularly fatal. High mortality is further to be expected with persistently and equally contracted pupils, with immobile pupils, and with pupils presenting alternating contraction and dilation.

The discussion of the after-results of head injuries offers many medico-legal suggestions. Traumatic cerebraesthesia is for the author a comprehensive term to include these affections, such as dizziness and headache together with changes in the mental makeup, which, while not meriting the term insanity, renders the patient different and less capable. The chief symptoms are headache, dizziness, irritability, ease of fatigue, change in character, and intolerance of alcohol. These cerebraesthenias have a general tendency to recover; but if not, and a mental predisposition exists, a definite psychosis may develop. As to the development of insanity, Bailey quotes Meyer's statement that in about one-half of 1 per cent. trauma can be said to bear any definite relation to the insanity. Werner's statistics show a relation of one-third of 1 per cent. Fracture at the base of the skull Bailey believes is a negligible feature in the development of a traumatic psychosis.

The author takes a fairly definite stand against the probability of the causal relation of trauma and a number of the so-called

chronic degenerative diseases, although stating that a dogmatic denial of such a nexus is not possible. For general paresis he takes the ground that the causal relationship is extremely unusual and difficult of proof; for tabes he says there is not satisfactory proof that it has ever been the sole result of trauma. A possible relationship, however, cannot be denied: In progressive muscular atrophy the evidence seems to show the probability,—in paralysis agitans and multiple sclerosis its possibility. It may be seen that the author takes a very conservative, and we believe, a very logical ground. Were he to insist on histo-pathological evidence to show the relationship of trauma to many of these chronic affections, his position would be probably even more dogmatic. As it is, it leaves the subject still open, pending further study.

The second part of the book deals with the functional side of the problem, in which the author discusses the traumatic neuroses of old, introducing, however, a wider and more rational view of the processes which in times past were marshalled under that head. A traumatic neurosis *per se* does not exist, and Bailey prefers to group them as traumatic neurasthenia, traumatic hysteria and unclassified forms. He first considers traumatic neurasthenia, drawing an excellent picture of this condition. Of the prognosis, his views are moderate and to the point. Most of the traumatic neurasthenias get well, but under the stress of litigation their condition, while not aggravated as badly perhaps as those suffering from traumatic hysteria, is not helped. The provisions laid down for treatment are excellent. The chapter on traumatic hysteria is especially full and instructive. It is a thoroughly modern, common sense presentation.

Final chapters on medico-legal relations, malingering, substitution, etc., and a bibliography close this standard treatise, the only one of its kind which is so eminently judicial and praiseworthy for its technical accuracy. SMITH ELY JELLIFFE.

OPERATIVE GYNECOLOGY. By HOWARD A. KELLY, A.B., M.D., LL.D., F.R.C.S. Second Edition. Revised and Enlarged. In two volumes. New York and London: D. Appleton and Company.

The first edition of this excellent and well-known work was issued from the press nine years ago. The second edition, which is now before us, has been rewritten by Dr. Kelly for the purpose

of presenting the important advances which have occurred in the interval in this field of surgical work. Although the two volumes have been subjected to a complete revision, the most notable change and advance is seen in the chapters dealing with the Urethra, Bladder, Ureters, and Kidneys—a field in which the author has done an immense amount of original work and in which he has spared neither time nor energy to bring the results of his labor before us in a most pleasing and instructive manner.

The same general arrangement has been followed as in the previous edition, the work being divided in two volumes, each of which contains almost seven hundred pages.

Several new chapters have been added to the work both by the author and by his co-laborators, notable among which is a new chapter on Abdominal Extirpation of the Cancerous Uterus, with 56 new illustrations by Dr. John A. Sampson. There are also excellent newly written chapters on the Use of the X-ray in Diagnosis, by Dr. F. H. Baetjer, one on Bacteriology, by Dr. W. W. Ford, and in volume II a new chapter has been added by Dr. Elizabeth Hurdon on Gynecological Diseases in Children.

The two volumes contain eleven plates and over 700 original illustrations, most of which have been executed by Max Brödel, Associate Professor of Art Applied to Medicine in the Johns Hopkins University.

Both from a literary and an artistic standpoint Dr. Kelly's second edition of *Operative Gynecology* will continue to occupy its place as a standard work of the very highest type. Foremost in originality, replete with interest and sound instruction, this work brought thoroughly up to date will continue to command admiration from those who read and study its pages.

WALTER A. SHERWOOD.

THE OPERATING ROOM AND THE PATIENT. BY RUSSELL S. FOWLER, M.D., Surgeon to the German Hospital, Brooklyn, N. Y. Octavo, 172 pages, fully illustrated. Philadelphia and London: W. B. Saunders Company, 1906.

Dr. Russell Fowler's book is devoted to a consideration of the personnel and arrangement of the operating room, the instrument and supply room, anæsthesia, the preparation and examination of the patient, and the general considerations in the after-treatment of patients who have been operated upon. The book

is primarily for the instruction and guidance of those who are to assist a surgeon in the surgical care of a patient. Although the book in itself expresses chiefly the opinion of one man as to the requirements of such assistance, still it has been developed from an experience in a great many hospitals, and is, to a certain extent, an expression of the methods used in some of the best hospitals in Brooklyn. If this book should be owned, read and carefully followed by every house surgeon in his care and preparation of patients before and after operation, there would be fewer calamities. As a book for nurses engaged in operating-room work, it will serve as a valuable guide. A very valuable addition to the work is the list of instruments and dressing materials commonly employed in most surgical procedures; this list covers very completely the ordinary operations of surgery. The work has been carefully prepared and is very practical.

PAUL PILCHER.

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ORIGINAL MEMOIRS.

PLASTIC RESECTION OF THE MAMMARY GLAND.

BY J. COLLINS WARREN, M.D.,

OF BOSTON, MASS.,

Professor of Surgery in Harvard University.

THERE has been so much difference of opinion among surgical authorities as to the treatment of benign tumors of the mammary gland, that this branch of the surgery of the breast has not kept pace with the improvements in operations for mammary cancer.

Once a diagnosis of non-malignant disease has been made, it often happens that no further treatment is thought necessary. On the other hand, many physicians think it wise to advise amputation of the breast for every tumor of doubtful nature. This situation has largely developed from an inadequate knowledge of the various tumors which grow in the mammary gland, and the relation of these tumors, and other morbid conditions of the breast associated with the involution of that organ, to what may be called precancerous stages. There is, however, a growing feeling that this difference of opinion is unnecessary,¹ and that some well defined policy should be adopted which would be more on a par with the present well recognized treatment of cancer of the breast.

It was with this end in view that my paper on classification of tumors of the breast was prepared,² and an operation was referred to which it is intended to describe a little more in detail in the present paper.

The operation is designed to take the place of those exploratory incisions which are often inadequate for the purpose, or are so situated as to leave a cicatrix in a part of the integument frequently exposed to view. It is also so planned as to expose freely every portion of the gland, and, therefore, to accomplish all that an amputation would in doubtful cases. An operation which can relieve the mind of the patient from all uncertainty as to diagnosis, produces no subsequent deformity and entails but little discomfort and sacrifice of time, seems well indicated as a substitute for the various forms of treatment which have from time to time been suggested—such as puncture, aspiration or small exploratory incisions. It is also well adapted to overcome the fears of those who shrink from any operative interference whatsoever.

It was doubtless with this idea in mind that Thomas³ recommended the incision which has since borne his name. In his short, but admirable paper, he points out quite clearly the relief from apprehension which such an operation gives, the slight exposure to risks, and the avoidance of all mutilation of person. His operation was substantially as follows:

“The patient standing erect and the mamma being completely exposed, a semi-circular line is drawn with pen and ink exactly in the fold which is created by the fall of the organ upon the thorax. This line encircles the lower half of the breast at its junction with the trunk.” The incision being made along the line, the lower half of the mamma is turned upward and laid upon the chest wall just below the clavicle. “An incision is then made upon the tumor from underneath, a pair of short vulsellum forceps firmly fixed into it, and while traction is made by these its connections are snipped by scissors, the body of the tumor being closely adhered to in this process, and the growth is removed.” Thomas calls attention to the absence of a depression in the breast following the operation, although no attempt at suturing the wound in the gland has been made.

In early operations I began with an incision similar to that described by Thomas, but have changed it to coincide with the edge of the outer hemisphere, as this incision gives a freer access to the upper hemisphere and at the same time to the outer hemisphere of the gland, regions more frequently the

seat of tumors than the inner quadrants. (Fig. 1.) By prolonging the incision slightly along the anterior axillary border, the breast can be thrown over towards the sternum, and the most remote regions of the gland freely exposed. As the breast falls not only downward but outward, when the patient is in the upright position, this incision is concealed from view.

The dissection should be carried down to the outer edge of the pectoralis major muscle; when the fibres of this muscle have been exposed the knife will have passed through the deep layer of the superficial pectoral fascia, a fascia which covers the posterior surface of the gland. This layer is separated from the deep pectoral fascia covering the pectoralis major muscle by a loose layer of connective tissue. A bursa is said by some anatomists to be found there occasionally, but I have never seen it. The loose connective tissue enables the dissection to be carried easily between the gland and the muscle, so that they are quickly separated from one another. The left hand of the operator can now manipulate the breast so as to expose the entire posterior surface of the gland. The gland tissue is covered by the posterior layer of the pectoral fascia, but is readily recognized beneath it, as are also any cysts of tumors which may be present. An incision radiating from the centre to the periphery of the gland should be made through the fascia, to expose the subjacent growth. The segment of the gland containing the tumor should now be removed by two radiating incisions which, meeting at the centre of the gland, include a V-shaped portion of its tissue. (Fig. 2.) The knife should make a clean cut through the gland tissue down to the loose adipose tissue which lies in front of the gland. This adipose layer should not be removed, as its presence is important in preventing a subsequent depression at that point. No attempt should be made to dissect out the tumor, whether it be solid or cystic. Solid tumors, such as the periductal fibroma, or a cystadenoma, are so intimately associated with the gland tissue that they cannot be "shelled out." The fibres of the capsule seem to be continuous with those of the stroma of the gland. Any attempt, therefore, at a dissection of the tumor

is followed by a considerable laceration of the surrounding tissues. It is desirable to avoid cutting into the cavity of the cyst, one or two of which are usually found in the same quadrant. Although the contents of the cysts are almost invariably sterile, it is possible that larger cysts may be situated in a portion of the gland system not far removed from the nipple, and that the germs of a future infection may have made their way into their cavities. In the case of a single solid tumor, the V-shaped wound should be carefully approximated with a double row of sutures, one adjusting the anterior edges of the wound and the other its posterior lips. The full thickness of the gland at each side will thus be brought into contact, and no gap left to cause a depression on surface of breast. (Fig. 4.)

In the case of the presence of cysts (in abnormal involution of the breast) a further exploration of the gland tissue is necessary, for although the group of larger cysts forming the tumor for which the operation has been performed, are usually clustered together in one quadrant, there are also numerous minute cysts in other parts of the gland which have escaped detection. If these are left undisturbed they may grow later, and involve a second operation. This complication actually occurred to me. It was, however, in my first case of plastic resection, and led to the adoption of the expedient about to be described.

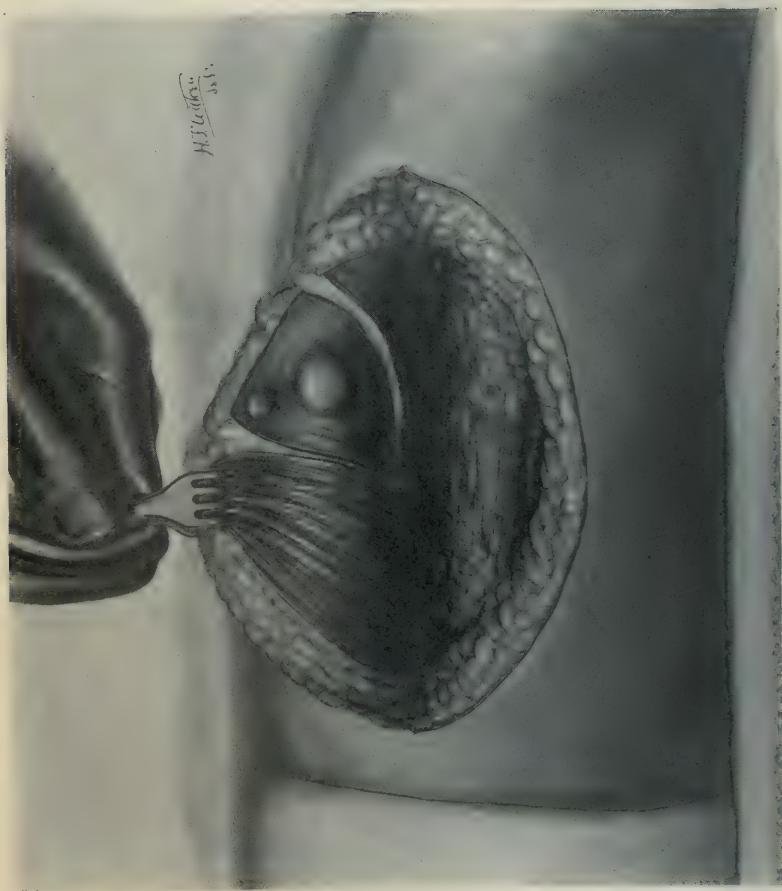
After the removal of the cluster of large cysts by the V-incision, the remaining segments of the gland can be explored by a series of radiating incisions. In this way all the smaller cysts are laid open, a procedure which is sufficient to ensure their permanent disappearance. Cysts the size of a pea can be snipped out with the scissors. Smaller cysts can be left after being laid open. The number of these radiating incisions may vary from three or four to double that number. It depends largely upon the amount of gland tissue present. Many breasts consist of but little else than adipose tissue interspersed with bands of connective tissue. Usually two or three such incisions suffice to satisfy one that the gland has been thoroughly explored. (Fig. 3.)

FIG. 1.



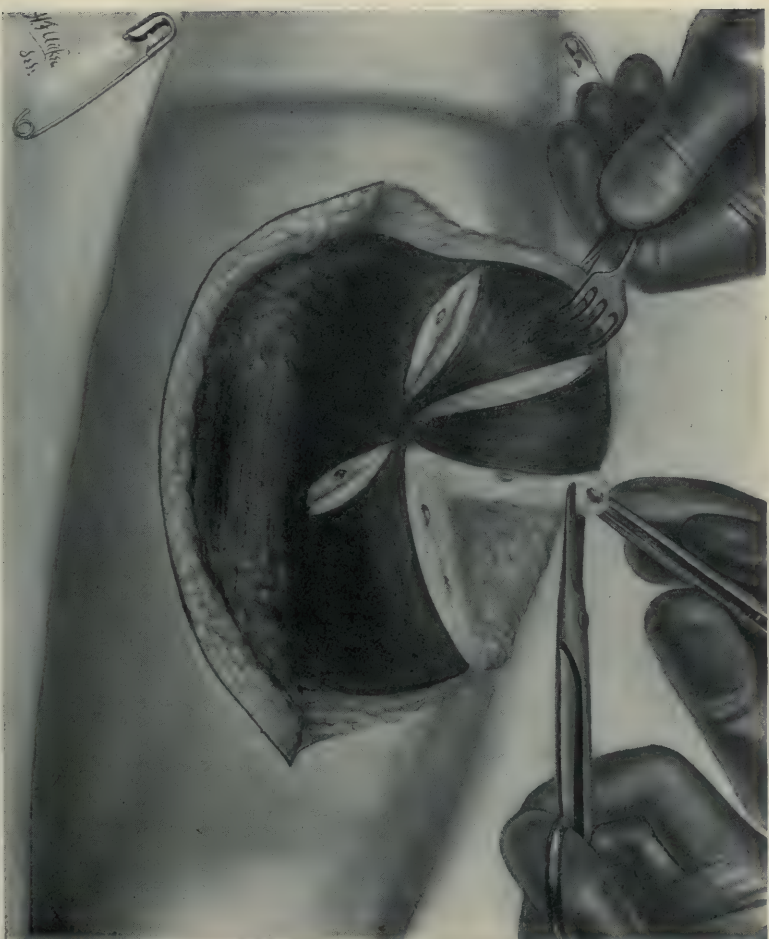
Plastic resection of the mammary glands.—Primary incision.

FIG. 2.



V-incision through posterior wall of gland, for removal of tumor.

FIG. 3.



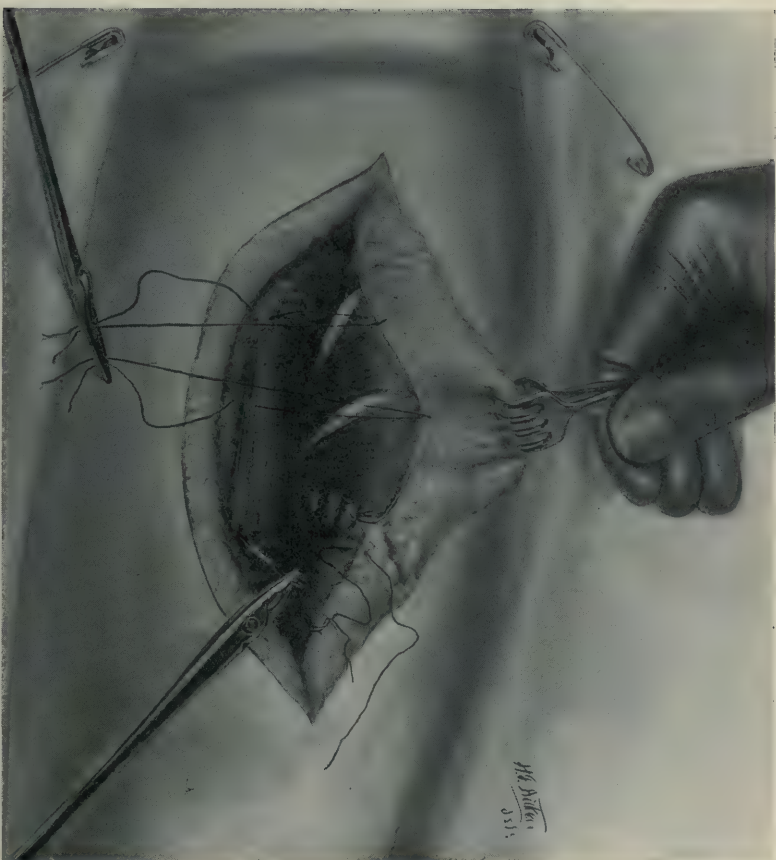
Radiating incisions following removal of large cyst.—Note excision of medium-sized cysts and incision of small cysts.

FIG. 4.



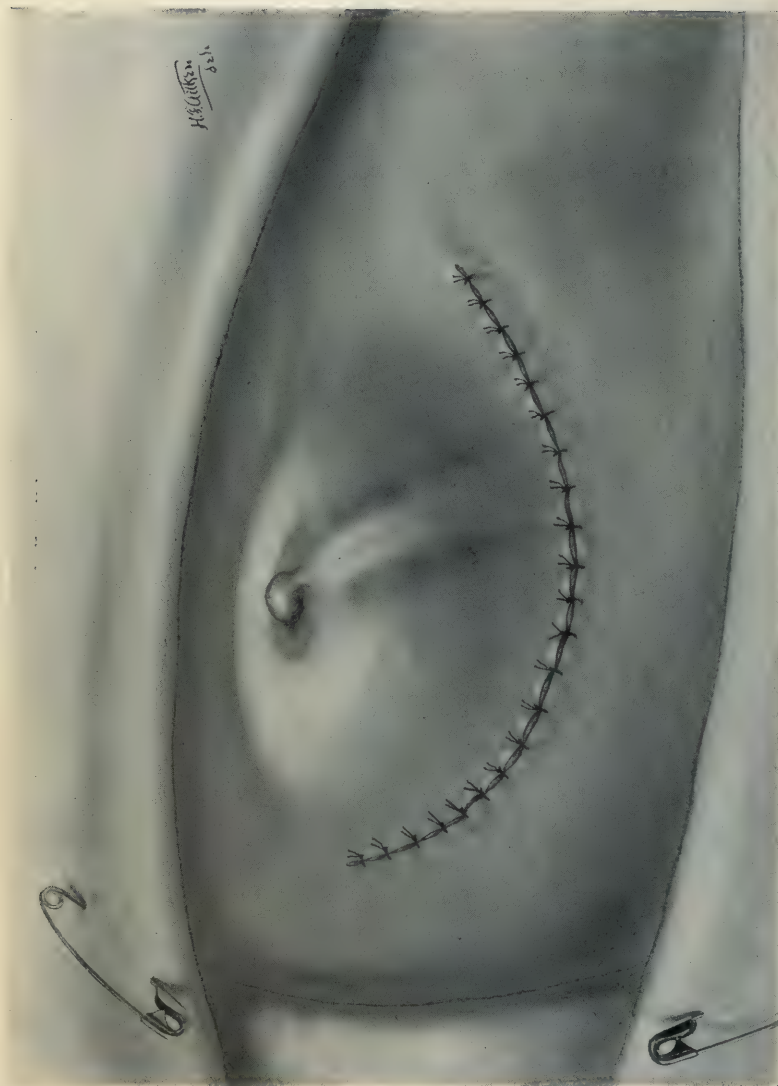
Method of suturing V-shaped wound.

FIG. 5



Adjustment of gland to outer edge of pectoral muscle. Note self closure of radiating incisions.

FIG. 6.



Appearance of breast immediately after application of buried sutures and closure of wound. These depressions soon disappear. Note prominence given nipple by purse-string suture.

FIG. 7.



"Empire bandage." Note box plait giving lateral compression.

In case an operation has been performed for the purpose of settling a doubtful diagnosis of malignant disease, the breast may be sliced almost as freely as a brain is at an autopsy, provided the radiating method is adopted, without danger of interfering with its vitality.

It is usually unnecessary to close these incisions with sutures, as their lips drop together naturally when the organ is folded back on to the pectoral muscle. (Fig. 5.) If, however, any tissue has been dissected out from the sides of one of these incisions it is well to catch the edges together with a single suture. In some operations a very large amount of tissue has to be removed, as in the case of larger cysts, and then it is difficult, if not impossible, to adhere to the radiating system of cutting. Keeping, however, in mind that nothing must be removed except acinous tissue, a great deal of the cortical portion of the gland can be saved and considerable portions of the stroma, and *all* the surrounding adipose tissue of the breast. The somewhat jumbled mass of tissue which remains behind may be so brought together by buried sutures, by the quilting or the purse-string methods of sewing, that a well formed breast may be built up from what is left behind. In some of my early operations I have removed the entire mammary gland, and have been able to build up a breast which had a normal appearance, the contour being preserved permanently. The radiating method, however, does away with the necessity of removing so large an amount of gland tissue.

A second V-shaped incision is occasionally necessary for large cysts in other quadrants, but I have rarely been obliged to resort to it. All hæmorrhage should now be arrested. This can be done partly by pressure and partly by ligature. Catgut is the only material that should be used for this purpose, as silk leaves a more or less permanent knot behind which may act as a source of irritation.

The V-shaped openings should next be sutured in the way above described (Fig. 4), and the gland is now released from the hand of the operator, and dropped back on to the pectoral muscle. It will be found that the various incised portions of

the gland resume their natural positions, and fit accurately together. (Fig 5.) A few sutures may be needed to arrest hæmorrhage from small arteries, where the ligature cannot be applied; but this is usually not necessary.

The gland should next be anchored to the outer edge of the fascia of the pectoral muscle. This holds the organ firmly in its place. (Fig. 5.) A second row of sutures should be taken through the deep layer of the superficial fascia before closing the outer edges of the wound with silk-worm gut. This last row of buried sutures is useful in removing strain from the surface sutures.

The outer contour of the breast now appears as a normal breast. Over the site of the V incision there are occasionally one or two deep depressions caused by the buried sutures. (Fig. 6.) This is more marked when a large portion of gland tissue has been removed; but, although in rare cases the buried suture appears to have caused considerable distortion of the breast, as the sutures are absorbed the depression subsequently disappears.

It is not an uncommon occurrence to find a folding in or inversion of the nipple, particularly in a case of abnormal involution (cystic disease). This condition should be distinguished from retraction of the nipple as observed in carcinoma. This deformity can easily be remedied during the operation by dissection from behind, so as to lay bare the base of the nipple, where a purse-string suture can be applied in such a way as to force the nipple outward. (Fig. 6.)

In cases of doubtful tumor, where cancer is suspected, the disease can be approached through the incision made for plastic resection. It is well, however, to carry the incision so as to separate the primary nodule from the lymphatic circulation by extending it a little farther along the axillary border. When the breast is freed from the pectoral muscle, all danger of forcing cancerous juice through the lymphatic channels is averted. If the nodule proves to be cancer, the small cut which has laid it open should be immediately closed by a suture, and the major operation proceeded with immediately. The dissec-

tion of the exploratory operation has not been sufficient to prevent the removal in a fairly compact mass, the breast, pectoral muscles and axillary contents. The exploratory skin incision coincides pretty accurately with the outer portion of the pear-shaped incision employed in my operation for cancer. It is, of course, undesirable to open the primary nodule of a cancer of the breast during an operation, if this can be avoided. When it becomes necessary, however, to settle a doubtful diagnosis, every precaution should be taken not to allow the freshly cut diseased surfaces to come in contact with those tissues that are to be left behind.

The term "plastic resection" has been used to describe this operation to call attention to the importance of taking into consideration the anatomical peculiarities of the gland, and its relation to the diseases for which the operation is performed.

The most frequent benign tumors to be operated upon in this way are the periductal fibromata seen so often in young women. As they sometimes become sarcomatous, I always advise operation. In one such tumor of twenty years' duration, I observed the development of carcinoma. When the epithelial tissues predominate to such an extent that we must remove the tumor from the fibrous class, and place it under the epithelial type and call it an adenoma ("fibrocystadenoma") there is still more reason for urging operation. The papillary cyst-adenoma or "duct cancer," the cystic tumor accompanied by a bloody discharge from the nipple, can also be removed by an operation for plastic resection. I have removed several such tumors in this way, without any subsequent sign of recurrence.

It is necessary to state here that it is my custom to have a pathologist present at the operation, capable of settling definitely the nature of the tumor, and it is worth while always to have the same pathologist if possible. This is not impracticable at the present time when the study of frozen sections, or even of free-hand fresh sections, can be carried on in the operating room. On one occasion only has a mistaken diagnosis, verified later in the examination of the hardened specimen, obliged me to perform a second operation.

The occasional development of cancer in the cysts of an abnormal involution of the breast emphasizes the importance of operative interference for the removal or destruction of all cysts of the mammary gland, whether large or small. As the larger cysts are usually grouped in one quadrant, they are easily removed entire in the wedge-shaped mass included in the V incision. (Fig. 2.) The radiating incisions lay bare the minute cysts dotted here and there throughout the gland, and practically convert the whole gland substance into cicatricial tissue. I have never known a cyst to recur after this operation. Some cysts when laid open exude a cheesy or puriform fluid. This is, however, sterile. When large cysts are opened, it is advisable to flush the wound with saline solution before closing it.

In acute and chronic suppuration of the mammary gland, it is a safer plan to follow such a method as will ensure thorough disinfection and drainage of the infected region. The breast is such a maze of branching canals and of anastomosing lymphatics that only most radical measures will suffice to arrest the burrowing of pus. It is, therefore, often necessary to supplement the original incision by one or more counter openings.

The operation of plastic resection has been performed by me 85 times. The mortality has been nil. In three cases only have I found infection in the wound, and this was attributed in each case to infection from the cavity of the cyst. One was a case of large multiple cysts; another was a large cyst near the nipple, and the third was a case of papillary cystadenoma near the nipple in a woman seventy years of age. I have tested many exposed cysts for bacteria, but have invariably obtained negative results. I should advise the operator to avoid opening the large cysts, if possible, and to use catgut for deep ligatures and sutures, as they are quickly absorbed and leave no trace of their presence in the sensitive structures of the gland. I have had stitch abscess in the skin sutures in two cases only, neither of which was in private practice.

The dressing should be applied so as to produce lateral

compression of the lower and upper hemispheres, as the ordinary swathe tends to flatten out the gland and put a strain upon the buried sutures. For this purpose I have devised the "Empire" bandage. The material of the bandage should be of compress cloth or cheviot about 5 inches wide, and long enough to encircle the chest and cross diagonally in front. At the point of crossing it should be caught with a safety pin, and pinned like a diaper. The ends which cross each other at right angles are then folded longitudinally so as to form a "box plait" and are attached to suspenders crossing over the shoulders. (Fig. 7.) A breast supporter has been elaborated for me from this bandage by Messrs. Leach & Greene of Boston. This supporter I have found useful in cases of mastodynia.

The advantages of this operation are the slight risk or discomfort to the patient, who may be assured that it can be performed without a prolonged convalescence and without disfigurement of any kind. In my hands it has proved a satisfactory substitute for the disfiguring exploratory incision on the anterior surface of the breast, for the uncertainty of puncture, and for the mutilation of amputation.

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THE CONTRIBUTIONS OF SURGERY TO A BETTER UNDERSTANDING OF GASTRIC AND DUODENAL ULCER.*

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CONTRIBUTIONS of surgery to our knowledge of ulcer of the stomach and duodenum are numerous and of high value, and, taken in conjunction with the recent work in experimental physiology of the digestive system, are throwing much needed light upon this obscure malady. In the past we have depended upon notoriously defective clinical examinations, supplemented by chemical and biological investigations of the gastric contents. These methods, while teaching some truths, often failed to demonstrate the actual condition present. Neither did post-mortem revelations give a clear picture of the situation during the curable period on account of secondary complications and terminal infections.

It is the purpose of this paper to examine the subject from the standpoint of the operating-room results, with a view of somewhat modifying the generally accepted opinions.

Ulcers of the stomach and duodenum can be divided surgically into two classes. First, the indurated or calloused ulcer, which can be seen and felt during operation, on account of the cicatricial tissue which gives the appearance and "feel" of a scar from the outside of the stomach wall. All the positive advances in surgical knowledge concern this group.

The second class has for its type the non-indurated mucous ulcer, which cannot be identified from the outside of the stomach or duodenal wall. The site of the ulcer does not betray its presence by thickening or other sign, and it is usually with much difficulty that it can be located even if the stomach and duodenum be opened and careful search made of the mucous

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membrane. We have on several occasions resorted to direct operative inspection when bleeding has been an important symptom, and have not always found it easy to discover the small mucous fissure which was responsible for the trouble.

Nearly all the failures of surgery are to be found in this group of so-called clinical or medical ulcers; because, (*a*) the ulcer is not located and many times its existence is problematical; (*b*) the condition is often confused with pyloric spasm, atonic dilatation, gastroptosis and the gastric neuroses, or other morbid non-surgical conditions; (*c*) the ulcer does not give rise to mechanical interference with the progress of food, which would introduce an operative indication.

The value of surgical contributions to our understanding of non-indurated ulcer is negative rather than positive in character and consists in teaching us errors in diagnosis and pointing out lines of future progress.

Location of Indurated Ulcer.—The relative frequency of ulcer has been placed at about 10 gastric to 1 duodenal. In St. Mary's Hospital between July 24, 1905, and March 23, 1907, 200 cases of ulcer were operated upon. Of this number 87 involved the stomach, 98 the duodenum and 15 were independent ulcers of each viscus; showing that ulcers which can be actually recognized are fully as often found in the duodenum as in the stomach. How can this apparent discrepancy between the older statistics and these facts be explained? The terminal three-fourths of an inch of the pyloric end of the stomach, the so-called canal of Jonnesco, does not take part in the grinding function of the antrum and is to be considered with the pyloric apparatus. It is therefore less exposed to the acid gastric contents and to mechanical injury.

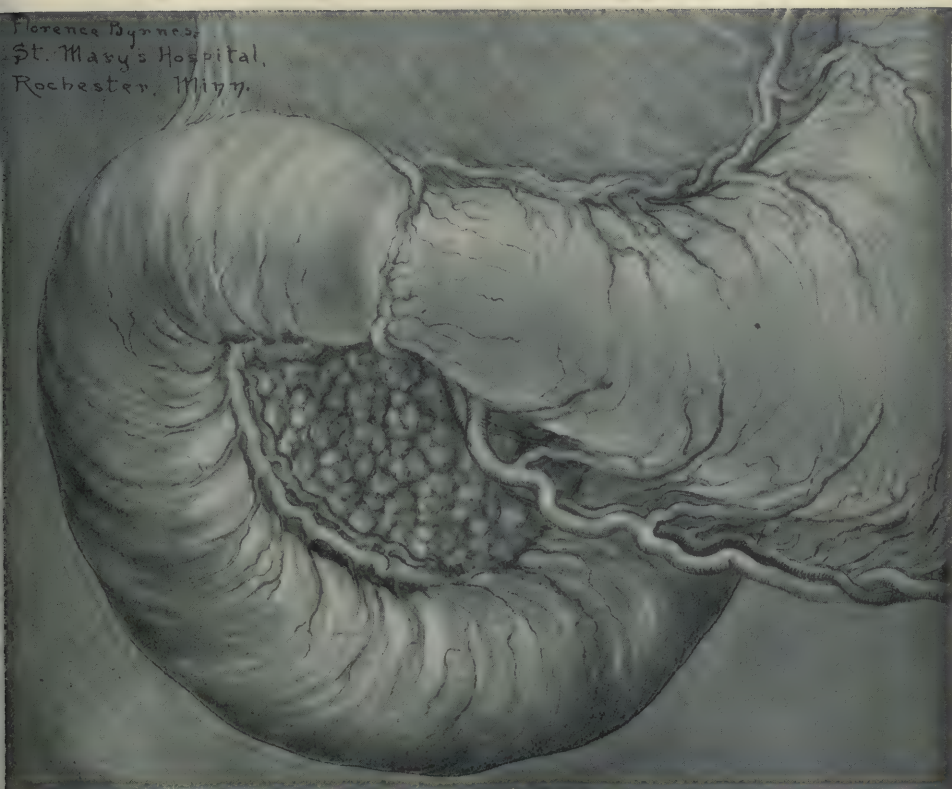
Ulceration of this canal is uncommon. The large majority of gastric ulcers involve the lesser curvature above the pylorus and extend downward anteriorly and posteriorly in a manner which we have compared to a *saddle*. Frequently an anterior and posterior ulcer thus exist connected across the lesser curvature by a bridge of cicatricial tissue. The posterior ulcer as a rule is the more extensive.

The typical duodenal ulcer is to be found in the upper inch and a half of the duodenum, and in 96 per cent. of the cases extends up to or within three-fourths of an inch of the pyloric sphincter. The deepest part of the ulcer will usually be found just below the pylorus, where the acid chyme, which is ejected with considerable force from the stomach, produces an impact upon the intestinal mucous membrane.

The fact that the ulcer extends up to and often involves the pyloric sphincter on the duodenal side, has led to the erroneous belief that the ulcer was pyloric, therefore gastric, and the statistics have been compiled on this mistaken identification. In the presence of an ulcer and with the parts more or less fixed by adhesions, it is often a difficult matter to actually determine the location of the pylorus. The best means of identifying it consists in the arrangement of the blood vessels, which is quite striking. A thick-walled vein is to be seen extending from the inferior margin of the pylorus on the gastric side, upward and across about three-fourths of its extent. From the superior margin a similar vein extends downward until it nearly or quite meets the one from below (Fig. 1). There are several variations from this which are shown in Fig. 2.

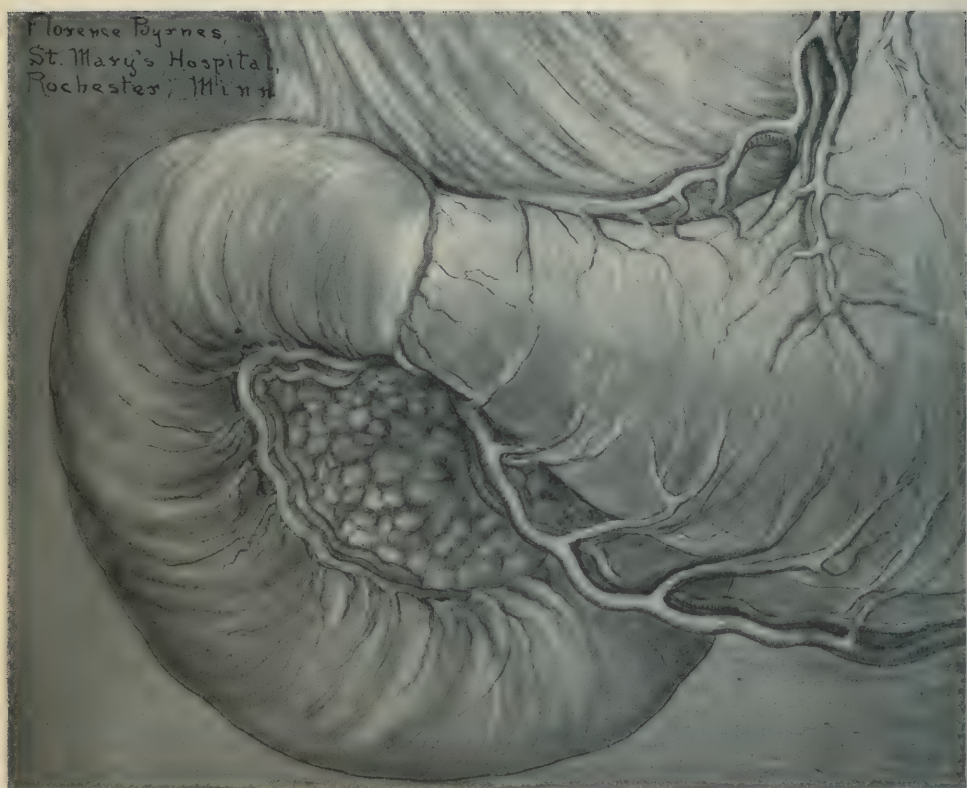
Relative Frequency of Indurated Ulcer in Male and Female.—It has been accepted as a fact that ulcer of the stomach, including the unidentified ulcer of the duodenum, is more common in woman than in man. Osler quotes the large statistics of Welsh and others, showing that 60 per cent. are to be found in women. The Fenwicks, on the contrary, give the proportion as nearly 80 per cent. in men. In Seymour Taylor's collection of 100 cases, he found 72 per cent. in men. In the operating room we found that 62 men were operated upon for gastric and duodenal ulcer to 38 women. On analyzing this percentage, however, it is to be noted that duodenal ulcer is found 77 times in men and 23 times in women, while in true gastric ulcer the percentage runs nearly even—52 men to 48 women; so that the percentage of male over female is due to the peculiar frequency of the duodenal ulcer in the male, and it is worthy of note that the percentage of gall-stone

FIG. 1.



Showing relations of blood vessels about pyloric end of stomach and duodenum, with special reference to pyloric vein.

FIG. 2.



Location of pylorus by means of the blood vessels. Pyloric vein.

disease is 76 per cent. in women to 24 in men, the reverse of the statistics just given for duodenal ulcer.

The duodenal ulcer occurs well above the common duct with its alkaline secretions. The curve of the duodenum in men is usually higher than in women; that is, the first portion of the duodenum in men is nearly always ascending, while in women it is often transverse. It seems probable that, for mechanical reasons, the alkaline secretions of the liver and pancreas more readily neutralize the acid chyme in the upper duodenum in women than in men.

Relation of Indurated Ulcer to Cancer.—In 54 per cent. of the cases of cancer of the stomach submitted to resection in 69 cases operated upon in 1905 and 1906, by Dr. Charles H. Mayo and myself, the clinical histories and pathological examination of removed specimens made it certain that the cancer had its origin in ulcer. Fütterer has demonstrated the development of malignant disease in portions of the gastric mucosa which had become separated and buried in scar tissue. The thick mucous membrane of the stomach, with its deep rugæ, is particularly subject to chronic irritation. In 80 per cent. of the cases the cancer had its origin in the pyloric end of the stomach, where the mucous surface is exposed to trauma, although the antrum has but one-sixth the total area of the gastric mucous membrane. The topography of ulcer and cancer are therefore the same.

We have seen but 3 cases of primary carcinoma of the duodenum. In one of these it seemed certain that the malignant disease had its origin in ulcer. In the second it was possible, and in the third the extent of the disease did not permit of a sufficiently thorough examination upon which to base an opinion.

Cancer of the duodenum is a rare malady, and its etiological relationship to ulcer is apparently not important. Five times, however, we have found cancer of the stomach developing upon the margin of a duodenal ulcer which had extended up to and invaded the pylorus, showing the susceptibility of the stomach to carcinoma as contrasted with the duodenum.

It is possible that the surgical conception of the frequency of gastric cancer developing upon ulcer exceeds the facts, as in a considerable percentage of our gastric resections for cancer the operation was begun with the belief that the disease was simple ulcer, and on exploration cancer was found engrafted upon it. The patient who has suffered long from ulcer is more willing perhaps to submit to operation at an early date than are those who have not previously been afflicted with gastric disorder. That cancer frequently develops upon an ulcer base, however, must be admitted.

Non-indurated Mucous Ulcer.—The important advances which have been brought out through surgical inspection of actual diseased conditions during life, which we have been considering, are based entirely on the fact that there is an ulcer present; that it is indurated; that about it there is a scar and other evidences which are so tangible that there can be no question that the disease actually exists. We now come to study a second class, in which the lesion is not demonstrated and the evidence that it exists is based upon notoriously defective clinical examinations. The lesion is supposed to be mucous, and therefore not to involve those external gastric and duodenal envelopes which would lead to accurate identification. The operation is undertaken upon an unproved hypothesis, and the results of the application of surgery to such indefinite condition throws still further doubt upon their actual existence.

That an *acute* non-indurated mucous ulcer does exist cannot be questioned. Evidence furnished by direct surgical inspection, by the operative repair of acute perforations, and by operations for acute hæmorrhage, demonstrate the fact which has been further attested to by post-mortem investigations of deaths from such acute conditions. Does there exist *chronic* non-indurated mucous ulcer, or is the belief in such a condition based upon our knowledge of acute ulcer and the inability to find chronic ulcer clinically diagnosticated? The whole subject is so interwoven with fact and fancy that at the present time it is nearly impossible to secure reliable data with which to lay bare the truth.

In contrasting the two groups, we find that *chronic indurated ulcer* as a rule produces certain phenomena. In the early stages there may be no mechanical symptoms, the distress being occasioned by the food and excessively acid gastric secretions passing over the sensitive ulcerated surface. In the course of time partial healing and development of large amounts of cicatricial tissue about the ulcer base lead to more or less interference with the progress of food, and if this amounts to retention the character of the symptoms change and become characteristic of obstruction. Evidences of blood are helpful, but not essential to diagnosis.

Chronic non-indurated mucous ulcer, if it exists, is certainly indefinite in its symptomatology. Pain, gas, distress after eating and moderate stagnation of food, with pyloric spasm, constitute the accepted chain of evidence. The nature of the supposed lesion does not lead to the formation of scar tissue, and, as a matter of fact, the symptoms are not only vague, but they are equally characteristic of non-surgical conditions. The actual demonstration of blood, in our opinion, is necessary to even give the evidence sufficient standing in court.

Of all misleading symptoms, pyloric spasm is the most mysterious. The term is given to an intermittent pathological contraction of the pylorus and antrum. Some authors seem to consider it a definite entity having a pathology of its own; the large majority of observers, however, look upon it as a symptom. The interesting and important question is, does it indicate ulcer?

In our experience, pyloric spasm is not regularly seen in indurated ulcer, but is an habitual accompaniment of certain other morbid conditions.

The derivatives of the primitive fore-gut consist of the posterior wall of the pharynx, the whole of the œsophagus, the stomach and duodenum to a point just below the common duct, the liver and pancreas being offshoots from that part of the fore-gut which is to become the upper duodenum. All of these organs are concerned in the preparation of food for absorption,

but do not themselves absorb. Looked at from this standpoint, we have the explanation why the first four inches of the duodenum is associated both in its physiology and pathology with the stomach. The duodenum below the common duct, the jejunum, ileum, cæcum and the colon to the middle of the transverse if not to splenic flexure, is derived from the mid-gut and is concerned in absorption.

Kölling, Cannon and others have demonstrated beyond a doubt that the control of the pyloric apparatus is largely vested in the duodenum. We have reason to believe that to a certain extent this control can be exercised by all of the just named derivations of the mid-gut.

We have seen most marked pyloric spasm giving definite signs and symptoms of supposed mucous ulcer, and upon exploration have found gall-stones or appendicitis, or tuberculosis of the cæcum. On all of these occasions the real seat of the disease was obscured by the stomach symptoms occasioned by the irregular pyloro-spasm. These experiences have been so numerous that we look upon pyloric spasm as an indication of an irritation in some part of the intestinal canal which causes an irregular attempt to close the pylorus and thus prevent food from entering the disturbed area. It can be aptly compared to the miner's sluice canal, the sluice gate being controlled by a pulley. Upon necessity for canal repairs the gate is closed, the disturbance appears at the top where the water is prevented from entering the canal.

We have never seen pyloric spasm in connection with diseases of the terminal portions of the bowel which are derived from the hind-gut. How is this control of the pyloric sphincter brought about? The explanation of this may be found in those splendid experimental studies of the physiology of the digestive tract which have been given to the world by Starling, Pawloff, Cannon and others. Briefly, it would appear that the maintenance of the body is to a large extent independent of the cerebrospinal system.

The stomach is partially controlled by the central nervous system through the effect on this viscus of sight, taste and

smell of food and also by the feeling of repletion which follows the full meal. Intermittent elimination of waste products from the sigmoid and rectum is more or less under conscious control. Through the plexuses of Meisner and Auerbach, acting conjointly with the sympathetic ganglia, the central nervous system has some minor influence on the intervening intestinal tract, but to a large extent the digestive system is still controlled by those primitive chemical messengers which Starling has named "hormones," aided by the sympathetic nervous system.

Hormones are the earliest of all forms of stimulation, and are perhaps the most important agents in the control of digestion. An example is the effect of "secretin" in the stimulation of the pancreatic secretion. Chemical stimulation is undoubtedly the most important factor in the movements of the stomach and intestines, acting as it does directly upon the gastro-intestinal muscle fibre, and is the cause of peristalsis.

The curious blending of the sympathetic with the ductless glands, which produces hormones, is exemplified in the adrenals, thyroids, parathyroids, etc., the products of which have gone under the name of internal secretions. We may here possibly get an explanation of that close association which exists between pyloric spasm, atonic dilatation, prolapse of the stomach and the gastric neuroses which have so often masqueraded as chronic non-indurated mucous ulcer. Be this as it may, the clinical fact remains that for various reasons, operations based upon the belief or actual existence of chronic mucous ulcers, have as a class been unsatisfactory, not that the mortality has been high, but the living through the operation has in a large majority of cases either failed to give relief or has introduced new elements of discomfort.

At the present time we do not consider that a diagnosis of mucous or other undemonstrated ulcer indicates a surgical operation without there exists complications such as perforation, hæmorrhage, or obstruction.

END RESULTS IN BENIGN LESIONS OF THE STOMACH SURGICALLY TREATED.*

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IN making this analysis and cross analysis of 150 benign stomach lesions, the patients have been followed from the operating room to the present time in all but a few unimportant instances. Nearly all have come in the service of Dr. Bottomley or myself at the Carney Hospital, so that the use of the term end result is limited to a space covering four years. We believe, nevertheless, that that is ample time to settle the question of success or failure in a preponderating majority of cases. I have tried not to err on the unfavorable side in making my deductions, I have balanced each case as judiciously as possible, allowing for the personal element and for the morale in individual instances, as influenced by long and fruitless medical treatment.

Of the total number of 150 cases, 87 showed gross ulcers in the stomach, in the duodenum, or in both. Sixteen cases belong to the class of so-called medical ulcer, where no gross, palpable, lesion could be found at operation. Twenty-five more exhibited well marked adhesions without evidence of an active ulcer. Among our earlier cases there were 15 so-called neuroses, and, finally, we had 9 cases classed variously as ptosis, spasm of the pylorus, etc.

There are many types of gross lesion in which we have secured immediate and permanent benefit from the operation. Among these we should include, first of all, congenital pyloric obstruction, and perforated chronic ulcer. The wisdom of surgical intervention in cases of this class is so self-evident that

* Read before the Congress of American Physicians and Surgeons, May 8, 1907.

we need not discuss it further. As to the question of immediate gastro-enterostomy in perforation, we believe that if, at the time of primary operation, the condition of the patient permits, an anastomosis is wise because it shortens convalescence and obviates the necessity for a secondary operation. The latter, however, gives good results and should be urged when patients have survived the preliminary operation. We have obtained good results also in (*a*), active ulcers near the pylorus but not necessarily occluding it; (*b*), in ulcers of the duodenum, with an occasional exception, which will be considered later; (*c*), in the gross chronic ulcers of the lesser curvature and anterior wall, in the pyloric half of the stomach, especially if there is active hæmorrhage; (*d*), in some cases of saddle ulcer; (*e*), in ulcers of the posterior wall, near the cardia, that infiltrate towards the upper edge of the stomach; (*f*), in ulcers of the lesser curvature when combined with adhesions that interfere with the gastric motility; (*g*), in some ulcers of the posterior wall when the pylorus is not mechanically interfered with; (*h*), in some ulcers at the œsophageal angle of the lesser curvature; (*i*), in ulcers of the greater curvature; (*j*), in hour-glass stomach; (*k*), in stricture of the pylorus; (*l*), in thickening of the pyloric ring without evidence of an active ulcer, and lastly, (*m*) in dilated, sagging stomachs secondary to some recent or early process in or near the pylorus, which mechanically interferes with the evacuation of the gastric contents.

In analyzing the partial successes in our gross ulcer cases, one must accept the patient's value of a disturbing symptom with some latitude. An invalid who, for years, has daily watched her digestive apparatus, will give undue prominence to eructation of gas, or to occasional attacks of vomiting while able, nevertheless, to eat heartily, to work hard and to maintain a normal body weight. In several failures in those types which, *a priori*, should have been completely cured, we found either a neurotic strain or some intercurrent disease, such as a severe cardiac asthma. A patient with a double hour-glass stomach, or with extensive ulcers and widespread adhesions, would not be completely cured because restoration to a normal

motility and to a normal secreting mucous membrane would be impossible on the face of it. Such patients, however, complain of symptoms so much less severe than those which obtained before operation, that we have no reason to feel otherwise than reasonably satisfied.

We have had definite failures in 2 duodenal ulcers and in 1 saddle ulcer, the condition being just as bad as it was before operation. From our experience in similar types, we had expected perfect results. To these failures we must add 2 cases of sudden bleeding (one being fatal) after complete relief for a year following gastro-enterostomy for duodenal ulcer. We also had a late, fatal, hæmorrhage in a case of extensive ulcer embracing both walls of the stomach. Experiences of this sort give us strong reasons for considering Rodman's plea for a more frequent excision, not only on the basis of relieving symptoms, but to prevent malignant degeneration and late hæmorrhage.

Among our gross ulcer cases there were 4 deaths directly attributable to technical failures. These came in the early period of our work. Other deaths were independent of the operation itself but consecutive to it. Patients that came to us after long periods of persistent vomiting were bad surgical risks, not influenced either way by a gastro-enterostomy. This type, among others, we have learned to leave alone. The deaths in congenital obstruction and in perforation of chronic ulcer, speak for themselves. In every case delay had been carried far beyond the limit of safety, and operation was advised as a dernier ressort. One patient with chronic anæmia, whose hæmoglobin was estimated at 15 per cent., died definitely from anæmia, but, as we had saved a patient with acute anæmia of corresponding degree by anastomosis, we felt justified in running the operative chance. Relapses after temporary relief took place in three cases. We can give no satisfactory explanation. Adhesions that kink the jejunal loop, peptic ulcer or other causes suggest themselves. That the anastomosis has not closed we feel very confident.

In 16 cases of so-called medical ulcer we found, as a rule,

hæmorrhage from the entire mucous membrane or from localized areas, but without any visible lesion. Every stomach, however, was not opened, the diagnosis being made on the clinical evidence of severe, acute, hæmorrhages or persistent, chronic, bleeding without palpable or visible lesion encountered at operation. Leukæmia and other general diseases were ruled out so far as lay in our power. We found an open, soft, pylorus in every instance. If there were ptosis or other evidence of a stomach draining itself poorly we obtained, by operating, a relief that was never more than incomplete. In two cases of medical ulcer we found the calcareous mesenteric glands to which Mayo has called our attention. Two alcoholics with severe hæmatemesis died promptly after operation from persistent vomiting. One woman with the typical history and symptoms of ulcer had persistent vomiting after a short-loop anastomosis. Pylorotomy was then done in desperation, but she continued to vomit steadily to death. Experiences in cases of this kind have taught us to close the abdomen when we are satisfied that there is no gross ulcer, no pyloric obstruction nor other crippling lesion. Without such positive evidence it is best to stop meddling with the stomach. If, in the so-called medical ulcer there is functional interference from ptosis, minor adhesions or other cause, it may be wise to make an anastomosis, but the surgeon need not count on the brilliant result that comes with typical ulcer and stenosis. Can we differentiate a medical case that is bleeding before operation? We believe that it is not always possible to do so. It is not infrequent that patients of this class are referred to us lacking the picture-complex of gross ulcer, and we are accustomed to refer them back to the medical wards for treatment. On the other hand, one of the largest ulcers that we have ever seen gave so typical a picture of the neurotic medical ulcer that we operated only on the general principle of "when in doubt, operate."

In 25 cases of adhesions without evidence of an active chronic ulcer, we obtained excellent results in all but 6, and of these 2 complain only of some eructation of gas. Two patients

with persistent vomiting before operation continued to vomit until death two and one-half and four weeks later. The adhesions for which we operated were, for the most part, firm bands or masses that extended from the pylorus or duodenum to the gall-bladder region. In many the pylorus was open but the functions of the stomach were evidently so interfered with that some relief to the food current was imperative. In a few we found the stomach dragged down by adhesions of the omentum to the pelvic scars of former operations. We often found merely the induration of an ulcer active at some former period, but at other times the adhesions were too dense and extensive to allow proper examination. Intercurrent gall-stones or other surgical lesions were dealt with at the same operation.

The worst subjects for interference were those classed as neurotics. Believing at the beginning of our work that the lack of gastric drainage was the main factor in the production of the protean symptoms in these patients, we undertook to relieve the distress by establishing free drainage. Most of the cases were made worse. In this respect it is interesting to note that quite recently, after exploring a neurotic that had been vomiting for a long time, and finding no causative lesion, the symptoms persisted until death two and a half months later. Three neurotic patients derived some benefit; one had a dilated, prolapsed stomach, another had a dilated duodenum and stomach, while the third had typical cardiospasm secondary to an irritable pylorus which was relieved by a Finney pyloroplasty. Some of these neurotics had severe hæmorrhages coming periodically both before and after operation when the neurotic storm was at its worst. A gastro-enterostomy would be followed in the course of a few weeks by regurgitation of bile. If we then made an entero-anastomosis and, perhaps, later closed the pylorus, the result was just as bad. Recently one of our most annoying victims allowed us to restore his gastric apparatus to its original anatomical arrangement with instant relief. Many of the patients had stomachs that were moderately dilated or prolapsed. Others exhibited scars on the serous coat, but in not a single case did we find a gross ulcer

or other crippling lesion. Sufferers of this class are still sent to us with remarkable frequency by the internist who has been battling with the condition for years, but it is needless to say that we refuse to interfere.

If, now, we study the results as they bear on the type of operation employed, it is evident that the simpler the technique and the nearer it follows anatomical lines, the better the result. The first method used is that commonly known as the Moynihan, beginning with the long and ending with the short loop. In this method the gastric and jejunal currents pass to the right, that is, in the same direction, the stomach opening being slit-like with its long axis practically in the direction of the food-current. Success with this operation came in patients with gross lesions where the establishment of drainage was a prerequisite factor. Failure naturally came in the medical ulcer and in the neurotic, but there were enough of the adhesion and gross ulcer type that had regurgitant vomiting to make us look for a substitute. Occasionally we were induced to reoperate, making an entero-anastomosis with a fair degree of success. We then tried the posterior gastro-enterostomy with primary entero-anastomosis, with rather better success, but still having an occasional case of regurgitation. Going then to the Roux operation-in-Y, modified by making both anastomoses with the clamp and suture, we were gratified by almost complete success. Unfortunately, however, the technique is somewhat complicated. We tried this method on one of our worst neurotics, feeling that bilious regurgitation would be impossible, especially if the pylorus were closed artificially. Nevertheless we were disappointed to find that almost constant regurgitation ensued. This demonstrated that the mechanics of a gastro-enterostomy may play a very unimportant rôle under certain circumstances, but conversely, we believe that almost any form of anastomosis will cure many cases of gross lesion. Following Mayo's lead we then adopted the no-loop operation, first with the longitudinal gastric slit, and later with the opening in the stomach transverse to the gastric stream. Here the jejunum points to the left as normally obtains in the majority

of cases. With each modification our results improved and we found less and less regurgitation until now we look for success as regards function if we select the proper cases for gastro-jejunosomy at the outset.

In the meanwhile we had used Finney's method of pyloroplasty in suitable cases, preferring it to Kocher's gastroduodenostomy as being simpler and more rational. The immediate results were more slow to manifest themselves in the individual case, but the end results were good. Finney, in a recent report of his own cases, shows that the method is suitable to a wider range of lesions than came within our application. He has obtained good results in active ulcers of the main body of the stomach, etc., and his conclusions are undoubtedly well worth consideration.

Excision of the ulcer-bearing area, which is likewise the cancer area to a great extent, would be the ideal process in all suspicious cases beyond middle life. But is it possible to insure against a fatal operative outcome as in simple gastro-enterosomy? Unfortunately many patients come late, with little power of resistance owing to prolonged starvation, anæmia and loss of courage. We cannot yet feel that our own technique is sufficiently reliable to make us have no hesitation in the choice of operation. Certain ulcers, extensive, brawny and of poor tissue to make repair, should be excised when by so doing the gastric function will not be impaired. In others we should make a partial gastrectomy, being willing to assume some additional risk if we can fend off a probable malignant degeneration or prevent a late hæmorrhage from an ulcer that is not capable of healing. This latter calamity happened in a few of our cases. The decision for the type of operation in such instances is individual, depending upon the surgeon's experience as well as upon the patient's condition.

We must confess that there are certain ulcers which at operation cannot be differentiated from cancer. In patients of this class, reduced by starvation and anæmia, we have lacked the courage to perform a radical operation and have been agreeably surprised to find that lapse of time has settled the

diagnosis of a benign lesion when our clinical diagnosis was that of carcinoma. Fortunately the reverse has happened much less often. As a rule the typical cancer is unmistakable, but in our experience of over 100 operations for cancer we have had only about 10 in which radical excision was possible; a proportion discouragingly smaller than that which has come in the experience of Kocher, Mayo and others.

After reopening a number of abdomens at varying intervals after anastomosis, we have failed to find any indication of closure of the opening when made with the clamp and suture. On the other hand the openings seem to enlarge, and this whether there is a functioning pylorus or not. With the Murphy button we have been less fortunate. Twice have we been obliged to substitute the clamp and suture anastomosis. One of these took place in a gastrectomy for cancer where there was no pyloric opening, and the other in a posterior operation for acute hæmorrhage. For this reason we make use of the button only in cases where speed or inaccessibility is an important factor. We have no definite data as to the occurrence of peptic ulcer. Such a lesion may explain the late unheralded hæmorrhage in two of our cases of duodenal ulcer. Rarely coming in the posterior operation, as statistics show, we believe the fear of this accident is a small contraindication in cases otherwise suitable for operation.

The simplicity, cleanliness, rapidity and safety of the clamp and suture operation are strong arguments at the present time against any substitutes. Complicated or so-called time-saving instruments, are unnecessary. A pair of simple rubber-covered clamps and a needle and thread should suffice in practically all cases. We prefer linen in the serous layer and fine chromic gut in the musculo-mucous layer. Ether given intelligently and in minimum doses, closure of the omental bursa against hernia and the elevated head position after operation assist in reducing the danger of the operation per se to a minimum. It is conservative to maintain that herein we have a very safe therapeutic remedy for most of the benign lesions of the stomach and duodenum. Further study, broader opera-

tive experience combined with associated medical observation, will soon enable the physician as well as the surgeon to accept suitable cases with a large promise for immediate and permanent cure. When relief does come it surpasses that obtained in almost any other type of suffering. It dispels the pain and distress of dyspepsia, the agony of slow starvation and the terror of hæmorrhage or perforation. Perhaps more than all it eliminates in a larger proportion of cases than is commonly realized, the chance of engrafted malignancy.

REMOTE OR INDIRECT SUBPERITONEAL DRAINAGE IN THE EXTRAPERITONEAL CLOSURE OF PERSISTENT FÆCAL FISTULÆ.

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By persistent fæcal fistula, we mean one which has existed for several months without showing any tendency to heal, or, having been of short duration, presents obvious mechanical obstacles to healing. The discharge from such a fistula may vary in amount from a slight fluid discharge to the turning of the entire fæcal current through the fistula. For convenience fistulæ may be divided into five grades or types. First, those which consist of a simple granulation-lined canal which extends through the abdominal wall and communicates immediately with the lumen of an unobstructed intestine (*A*, Plate I). This variety usually heals without surgical aid or, at most, may be healed by curetting the wound thoroughly or cauterizing it. Second, that variety in which the fistula is large; the intestine is attached to the abdominal wall; the mesentery is long, and intra-abdominal pressure forces the posterior intestinal wall into or through the opening, along with its mesentery, thereby producing a hernia (*B*, Plate I.—Intra-abdominal pressure indicated by black arrows). Observed through the opening, what appears to be a tumor covered with mucous membrane presents. A probe or a pair of forceps applied reduces the hernia without resistance, but immediately it returns as the result of intra-abdominal pressure. If the posterior intestinal wall barely engages, as is shown by *B*, Plate I, we would class it as an incomplete reducible hernia. If the posterior wall comes out partly through the opening and can still be easily pushed back, we would class it as a complete reducible hernia. The incomplete reducible hernia is produced and maintained because of the opening in front of it and the intra-abdominal

pressure behind. The hernia resists the normal passing of the faecal matter along the intestine and therefore obstructs (indicated by white arrow) to an extent proportionate to the size and completeness of the hernia. If the wound rapidly contracts, thus offering some resistance at the outlet, the intra-abdominal pressure proportionately becomes weaker as the opening gets smaller until the hernia is overcome by the faecal current, and the fistula which remains is reduced to type (A, Plate I) which finally heals spontaneously. If the opening of the reducible incomplete hernia, by retraction of muscles or for other reasons, remains large for a long time, this hernia gradually becomes fixed by union of the peritoneal surfaces on the mesenteric border of the intestine. This, then, becomes an incomplete irreducible hernia and is called a spur. If we have a complete reducible hernia in which the posterior intestinal walls become actually engaged in the fistulous opening and are allowed to remain in that position for any length of time, the pressure of the cicatrizing wound gripping the hernia causes a blending of the peritoneal surfaces included in the hernia, and forms a complete irreducible hernia which turns a large portion, if not all, of the faecal matter through the fistula and is practically an artificial anus. This kind of a fistula always demands surgical aid. This kind of a hernia is also called a spur. Then a spur may be defined as an irreducible hernia of the posterior intestinal wall with its mesentery and may be complete or incomplete.

Mikulicz suggested that a spur might be the result of peristaltic action, pulling away the afferent and efferent loops of the intestine from the point fixed to the abdominal wall, until they paralleled each other (von Bergman-Bull, *System of Surgery*). However, it is probable that this only happens after the fistula becomes so small that intra-abdominal pressure ceases to force the posterior intestinal wall out through it.

C, Plate I, represents an artificial anus which is a complete irreducible hernia from the beginning, and which has been deliberately produced. In this case a definite spur is formed as soon as the wound has had time to contract. In this

PLATE I.



Types of faecal fistulae.—*A*, Simplest form. *B*, Spur formation or reducible hernia type. *C*, Artificial anus or irreducible hernia. *D*, Fistula leading to intestine remote from abdominal wall. *E*, Fistula leading to large cavity resulting from gangrene due to mesenteric embolism. *F*, Fistula leading to intestine above cancer.

PLATE II.



Skin incision.—1, Incision through skin, forming long wound, and surrounding the fistula.

we have a purely surgical condition. This fistula is usually created for temporary drainage of the intestine, and the extent of the hernia depends upon the circumstances of the case. *D*, Plate I, at first sight, seems to represent an entirely different class of fistulæ. It is one in which a sinus leading through the abdominal wall communicates with an intestine located at some distance from the wall. Such fistulæ are usually found leading to some part of the more or less fixed colon. In the writer's observation most fistulæ of this type are found leading to the pelvic colon and, as a rule, have communicated with a pelvic abscess or are the results of tearing the rectum during pelvic operations. This type of fistula seems to be maintained by an obstruction which may be more or less physiological, in front or below the fistula. It seems that some of these fistulæ leading to the pelvic colon are maintained by the action of the sphincter ani. When the rectum attempts to expel its contents, the force is exerted partially through the anus and partially through the fistula, as by squeezing mush in the hand, forcing it between the fingers. In this class of fistulæ the expulsion of semi-solid fæcal matter may continue for months or even be permanent. We may admit that the majority of these fistulæ get well of themselves, but many of them do not, and many others persist for months longer than should be allowed. This form of fistula, in addition to the class just mentioned, may be maintained by a pathological obstruction such as a complete volvulus below the fistula, a malignant or tuberculous growth below the fistula (*F*, Plate I), a sloughing of a section of intestine which may be due to mesenteric embolism, etc. (*E*, Plate I). These fistulæ are the result of a distinct pathology which should be considered and named as the primary lesion. We may call this form conservative fistulæ. This variety can only be treated by intraperitoneal operation, and therefore does not come within the range of the subject under discussion.

I believe that forms *A*, *B*, *C*, *D*, of fistulæ shown in Plate I, are curable by extraperitoneal operation performed in the manner to be described later. Every surgeon of wide experience

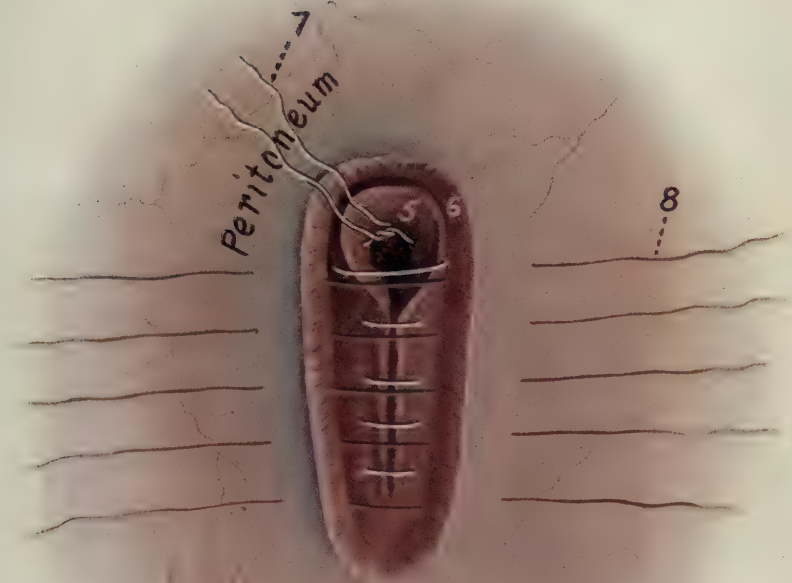
must look with a certain amount of horror on an attempt to cure fæcal fistulæ by radical dissection and excision, for in this most surgeons have had an experience somewhat alike as regards mortality, if their experience covers sufficient number of cases. Makins found 38.4 per cent. mortality, Bryant in his latest text-book of surgery, just two years old, 28 per cent., Tillman 27 per cent. In fact, I think every surgeon finds that some of the most formidable experiences he has encountered have been in the attempt to dissect out deep seated fæcal fistulæ. It is no doubt true, however, that this mortality would be materially reduced by leaving out the conservative or essential fistulæ illustrated by *E* and *F*, Plate I. As a result of this formidable mortality various plastic operations have been devised and tried, but have been found wanting in the persistent cases, as is shown by the fact that in many of the most modern text-books not a single plastic operation has been described, the authors confining their descriptions to intraperitoneal operations. The best plastic operation and the one which has received the most recognition was described by Greig Smith a number of years ago. He reported splendid success with the operation, but subsequent operators have not been able to get as good results. He made a long incision, as is indicated in the operation herein described, keeping far away from the fistula until he reached the peritoneum, which was dissected loose from the muscle for two or three inches around so as to get room to draw the fistula well out of the wound, for convenience of manipulation. He apparently disregards the layers. The fistula was then excised, taking care not to open the peritoneum, and sewed up. Another layer of sutures was taken, turning in the outer side of the peritoneum still farther, and including the neighboring connective tissue. The intestine was then pushed back inside the abdominal wall and the wall closed by through and through stitches which, according to his original drawings, interlocked with the last stitch used in closing the fistula, which brought the intestine or the fistula in contact with the muscular wall. He recommended in certain cases, insertion of drainage down to the line of intestinal sutures. Owing

PLATE III.



Wound dissected and layers separated ready for suturing.—2, Dissect fat off the fascia for two inches away from the wall. 3, Separate fascia from muscle. 4, Dissect the peritoneum away from the muscle for two inches on every side. 5, Remove margin of skin around fistula which has been left. 6, Make superficial incision around cicatricial canal.

PLATE IV.



Closure of the fistula proper.—7, Turn in fistula proper with linen suture knotted on the inside after method of Connell. 8, Bring the raw edges of the cut together with catgut sutures, including connective and cicatricial tissue.

to the fact that in these cases we are dealing with a septic field we are left to choose between the two horns of a dilemma in many cases. If we do not drain, the wall becomes infiltrated with septic or fæcal matter, which completely destroys our union; while if we drain, after the manner recommended by Smith, down to the line of sutures, we invite a return of the fistula which is again kept open in many cases by the same cause which kept it open before.

After studying the subject of fæcal fistulæ as it is given in the literature and as observed in a considerable number of personal cases, I have reached the conclusion that fæcal fistulæ, aside from the essential or conservative fistulæ which are due to an actual mechanical obstruction beyond the opening, such as a volvulus, or tubercular, or malignant process, persistent fæcal fistulæ are for all practical purposes the same as herniæ, and the treatment is exactly the same as for hernia, plus a special provision for drainage. If we should find a leak in a mill dam we would not attempt to repair it while the pond was full and running over the top of the dam, but would run the stream of water out through gates, over which we had control, until we had repaired the break in the dam. This, it seems to me, is the principle involved in the cure of fæcal fistula. The field is septic, therefore we cannot effect primary closure of the fistulous tract itself as a rule. We must, therefore, prepare to carry off this stream of fæcal matter through a channel which may afterwards be closed by natural forces while the break in the wall is being mended. If we drain directly we have the same fistula as when we started. In fact if we insert drainage in any direction so that it reaches the actual fistula, there is some danger of creating a cicatricial drainage tract which would be hard to close. In the study of this subject and its collaterals, I have reached two conclusions as to surgical principles.

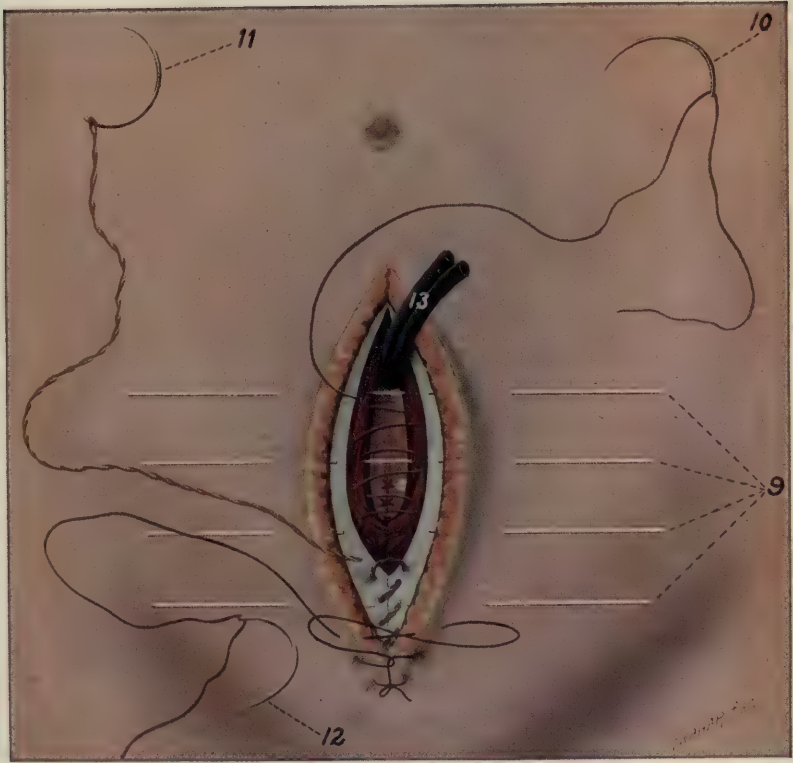
First, There seems to be an irresistible tendency on the part of the peritoneum to cling to its abdominal wall. This is brought about by two forces: one is the normal resiliency of the hollow abdominal organs which is known as intra-ab-

dominal pressure; the other is the great power of the subperitoneal connective tissue to hold the peritoneum in contact with the muscular walls of the abdomen loosely and yet persistently. If the uterus is attached to the loose peritoneum which has been detached from the wall, it is found in six or eight days that in what we left as open space there is an exudate which binds the peritoneum back to the abdominal wall and holds up the weight of the suspended organ. Six months later the exudate has disappeared and an excess of subperitoneal connective tissue has taken its place, holding the peritoneum more solidly to the wall than normal. The same holds good in suspension of the liver in which the organ has to be lifted upwards by the connective tissue.

Second, I have observed that in doing abdominal operations in which virulent sepsis was encountered, if sufficient drainage was inserted into the cavity and allowed to come out through the lower end of the wound, no matter how large the rest of the wound may be, by using layer sutures it can be closed in the presence of the sepsis with as full assurance of getting primary union as if it had been perfectly aseptic. The drainage takes place between the layers, thus protecting the sutures and closing the space as soon as the sepsis has been eliminated. Taking these observations as a basis, I have formulated the method of treating fæcal fistula shown below. If the fistula is discharging profusely it is well to first pack a strip of gauze into it, then take the following steps:

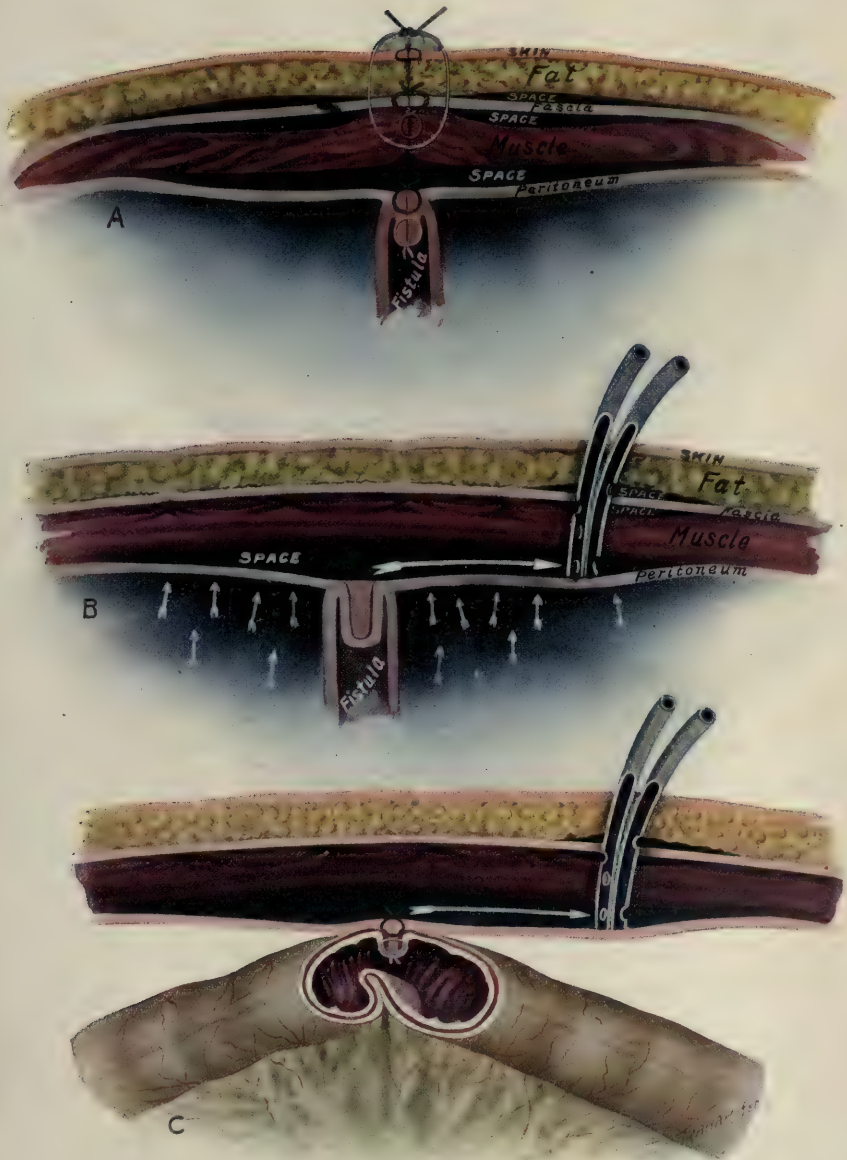
(1) Dissect out the old scar down to the fat and make an incision around the fistulous tract, including a small strip of skin, direct the point of the knife slightly away from the fistula so that it first comes in contact with the fascia about half an inch away from the fistula, in order to avoid any possibility of opening the peritoneum. (2) Dissect up the fat from the fascia for as much as two inches from the incision, draw it back, clean off the fascia. (3) Make an incision through the fascia, beginning at the upper end of the wound and coming toward the fistula. Dissect the fascia from the muscle for at least two inches in every direction. (4) Dissect the muscle from the peritoneum in the same manner so that the peritoneum hangs

PLATE V.



Closure of the abdominal wall with layer sutures.—9, Silkworm gut sutures left untied. 10, Bring the muscular layer together loosely with catgut suture. 11, Suture fascia with heavy double catgut. 12, Suture the skin with button horse-hair suture. 13, Place drainage in the upper angle of the wound.

PLATE VI.



Diagrams showing sectional views to illustrate the mechanism of the suturing and drainage.—A, Transverse section through the fistula and layers of the abdominal wall. B, Longitudinal section in line of the incision shown in the previous picture. C, Result following closure of artificial anus.

loosely with the fistula standing up in its centre like a volcano and its crater. (5) The little margin of skin which has been left with the edge of the fistula is now trimmed off. (6) If the wall of the fistula is hard and cicatricial, making it difficult to turn in, it is well to make an incision part of the way through the cicatricial tissue so that it may be turned in easily. (7) The edges of the fistula are turned in with linen sutures which are knotted on the inside. (8) A second layer of sutures brings the edges of this incision and the connective tissue over the peritoneum along with the scar tissue, covering the turned in fistula, to add temporary strength and bulk to the closure. The peritoneum and the rest of the wound is now thoroughly mopped or irrigated with salt solution to make it as clean as possible. (9) silkworm gut sutures are passed through skin, fat, fascia and muscle about a half inch or more from the edge and left untied, space being left at the upper end of the wound for drainage. (10) Suture the muscle loosely with a continuous catgut. (11) Suture the fascia with a strong double catgut. (12) Suture the skin with a horse-hair button-hole stitch. (13) Place the drains, which may be tubes or cigarette drains. No matter which is used, I have been in the habit of placing two or three wicks of gauze along the side to help hold the drainage in and keep the opening patulous. A roll of gauze is laid on each side of the wound and silkworm gut sutures are tied over the gauze. *A*, Plate VI, shows a cross section through the fistula in which is represented all the different layers of sutures, all the different layers of the abdominal wall, and the spaces between the layers which have resulted from the dissection, and which are for the purpose of draining away septic materials from the sutures. The lateral spaces between the fat, fascia, and muscle serve as drainage channels to conduct any septic material or fluid around the line of sutures to the drain at the upper end of the wound, as shown in the next figure. The sutures are represented as interrupted sutures for purposes of illustration, but they are actually placed as shown in Plate V, namely, a series of continuous sutures.

B, Plate VI, represents a longitudinal section through the fistula which corresponds exactly to the principal incision in

the abdominal wall as shown. This figure is made to represent the effect of sutures holding the various layers of the abdominal wall together, without actually showing the sutures. The large arrow going toward the drainage tubes represents the direction of drainage from the fistula. The small arrows show the direction of intra-abdominal pressure which gently but persistently forces the fluid in the direction of the drainage tubes. The two spaces above and below the fascia illustrate method by which the lateral spaces shown in Fig. *A* are brought in contact with the drainage. These two figures (*A* and *B*, Plate VI) illustrate the mechanism by which drainage is arranged to completely protect all the sutures. These sutures are allowed to remain for about two weeks before the horse hair and silkworm gut are removed. At the end of this time union in the abdominal walls should be perfect. In the meantime, any material which may have come from the fistula has been carried beneath the peritoneum and delivered to the surface through the opening at the point of drainage. In five out of the seven cases treated by this method the necessity of drainage was proven in that the fistula leaked about the fifth day, continuing from five days to three weeks. In the meantime new connective tissue is forming back of the peritoneum and is gradually closing off this space between the peritoneum and muscle, as was mentioned as being true in cases of ventro-suspension. The reformation of subperitoneal connective tissue seems almost irresistible.

C, Plate VI, represents the transverse closure of an artificial anus, in which the colon was brought to the surface and deliberately opened. It will be noted that the spur has not been entirely obliterated by the operation, but has been so reduced as to allow of passage of intestinal contents easily. The dissection in such a case is made in exactly the same manner as illustrated in the pictures. In such a case the spur may be obliterated partially by some of the well known methods of the Dupuytren type, or with the Murphy button, as has been used by Byrant, before the closure operation is performed, if it is so firm as to form an obstruction. This method of obliteration may also be necessary in cases of gangrenous loops of intestine in which part of the intestine has

sloughed, leaving two parallel ends open. If the operator is fortunate enough to think of the cure of this artificial anus at the time he is drawing out the loop he may sew the intestines together for some distance, so that he can obliterate the septum without any danger. After this septum has been obliterated it is a very easy matter to close the fistula by the method which has been described.

The variety of fistula as shown in *D*, Plate I, has been used as the basis of our illustration for three reasons. First, I happened to have a case of this variety at the time the pictures were being made. Second, It is one of the most difficult and serious varieties to close by an intraperitoneal operation. Third, It is located in the linea-alba where the layers of the abdominal walls are simple, making the operation easy to illustrate.

The same method, however, is applicable at any point of the abdominal wall, always remembering that every layer must be dissected up for some distance away, and that each must be sutured separately. It may not be essential, but I feel it is better suturing to enclose all the layers in one deep silkworm gut suture, as shown by this picture. The drainage is removed in one week after the operation and wound is not repacked.

Since beginning to use this method I have closed seven consecutive fæcal fistulæ, of from four months to two years standing, without a single failure or without a single stitch infection,* while similar cases prior to the time I began to use it were not treated successfully by plastic operation in all cases. and in the deep fistula in which I attempted to do a radical excision I found serious complications and large mortality.

In all cases of fæcal fistula represented by Types *A*, *B*, *C*, *D*, Plate I, I would begin with almost absolute assurance of being able to close them without opening the peritoneal cavity. Of course in cases represented in *E* and *F* no plastic operation is of value, as the fistula is not the real pathology.

* Since this paper was sent to the publisher the last patient operated on by this method writes that some time after she left the hospital something like a blister appeared at the lower end of the incision, followed by a slight discharge of serum and then healed again, but the same process has been repeated at intervals since. She states that her doctor thinks there is a stitch at the bottom of it.

LIPOMA OF THE INTESTINE OCCURRING IN A CHILD THIRTEEN MONTHS OLD AND CAUSING SYMPTOMS OF INTESTINAL OBSTRUCTION.

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LIPOMA, as an intestinal tumor, occurs very infrequently. Hiller in 1899 collected twenty-three cases. A later review by Ward, including the cases reported by him, increased the number to thirty-five and in a recent very comprehensive review, Dewis has added nine additional reports. The rarity of the lesion, the early age at which it appeared in the case here given, the peculiar symptoms to which it gave rise and the fact that the literature contains no reference to a similar condition in an infant, makes the following report worthy of publication.

Clinical History.—Female, aged 13 months, appeared for operation Sept. 13, 1906, with symptoms of intestinal obstruction.

Family History.—Negative.

Past History.—The child was born July 12, 1905, after a normal labor. It was breast fed and appeared well nourished at first but later showed slight signs of rickets. Two or three months after birth, the mother noticed that the left side of the abdomen appeared unusually full and round. She attributed this, however, to the healthy condition of the child. At that time there were no stomach symptoms, but a slight "colic" appeared which continued daily for four or five months. The attacks later however diminished in frequency, there being intervals of two or three weeks, during which the child appeared perfectly well. Defecation has always occurred two or three times a day. The fæces were soft in consistency; well formed stools have never been seen.

Present illness began July 15 with vomiting and marked

flatus. Rectal enæmata were given and afforded complete relief. The child then remained well until August 7 when she had a similar attack, the same treatment again proving effective. During these attacks the mother noticed a "bunch" in the left side of the abdomen, which remained after the attacks had subsided. She had similar attacks on August 20 and 30. On September 9 continuous vomiting developed and marked constipation which nothing could relieve. The patient became steadily worse and was brought to the Benedictine Sanitarium in Kingston, N. Y., September 13, 1906. At this time the child was in a precarious condition; the pulse was barely perceptible; the abdomen markedly distended and vomiting continuous.

Operation.—Ether anæsthesia. Incision in the median line. Removal of a large pedunculated tumor occupying the right portion of the abdominal cavity and attached to the sigmoid flexure opposite the mesenteric attachment by a short pedicle 10 cm. in length. The tumor had rotated in such a way that the intestine was twisted twice. The tumor was removed by cutting the pedicle close to the intestinal wall. The child made an uneventful recovery and left the sanitarium two weeks later.

Pathological Examination.—The specimen consists of a kidney-shaped mass 12 x 7 x 9 cm. with a broad pedicle attached to the concave side or "hilum." The surface is everywhere smooth and glistening. Beneath the surface are numerous hæmorrhagic areas averaging 2.5 cm. in the greatest diameter. At the point of attachment, the mass is definitely lobulated. On section, the yellow tissue is mottled with numerous hæmorrhagic areas, which are especially abundant at one pole of the tumor. The tumor substance shows in places a division by fine strands of connective tissue into definite and rather large lobules. Elsewhere it presents a lamellated appearance, no lobules being visible. The mass is rather elastic in consistency and on pressure a fatty material is expressed. Microscopic examination reveals a pure lipoma with areas of hæmorrhage.

Anatomical Diagnosis.—Lipoma with numerous areas of hæmorrhage.

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A MALIGNANT TYPE OF PSEUDOMYXOMA PERITONEI PENETRATING THE SPLEEN AND COLON.*

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THE number of cases of pseudomyxoma peritonei recorded is so great that the report of a simple case is no longer justifiable. I have been unable, however, in the search of the literature to find a single case which presents the same pathological picture as one of the cases which I desire to report.

To the French belong the credit of having first described these tumors; but it was not until 1874 that Beinlich, in the Charité records, reported in detail two cases, describing the process as a myxomatous degeneration of the peritoneum. This explanation was generally accepted by Virchow and others, until 1885 Werth in his classical paper gave an entirely different interpretation of the pathology. Donat confirmed these findings two years later.

Werth introduced the term pseudomyxoma peritonei, which is accepted even to-day, but not in the sense of the original article, which described one distinct process. At the present time several separate and distinct pathological conditions have been described. Strassman, as early as 1891, collected three distinct processes, namely: 1. Myxomatous degeneration of the peritoneum (Virchow, Wendler). 2. Rupture of the original tumor with escape of the gelatinous substance, which becomes intimately adherent to the peritoneum (Werth). 3. Development of cysts with the same structure as the original cyst (implantation of Olshausen).

The myxomatous degeneration of the peritoneum was more or less discarded following the monograph of Werth, and has up to the present time found few adherents. Wendler in

* Read before the St. Louis Gynecological and Obstetrical Society, February 14, 1907.

1896 became a strong advocate of this view. Westphalen claims that the microscopical pictures have been falsely interpreted, and regards the condition as due to the absorption of the gelatinous substance into the lymphatics of the peritoneum.

While the question of the existence of a myxomatous degeneration is very doubtful, and was certainly not noted in the two cases to be reported, the findings of Werth and, of more importance, the development of implantation cysts, were observed in both cases. It will be seen from the report of the first case, that further subdivision of the group of implantation cysts is necessary, for none of the reported cases are in any way similar, save probably the one reported by Polano, further mention of which will be made later.

CASE I.—Mrs. L.; age sixty-six years. Entered the hospital March 2, 1903, on account of an enlargement of the abdomen. Seen in consultation on the same day. Family history: Father died of paralysis at seventy-three years. Mother died at fifty-five years, of insanity. Several members of the immediate family were mentally unstable. Previous history negative. First menses at thirteen years. Menopause at fifty-one years; came gradually and with no pronounced symptoms. Has four children, all living and healthy. Patient has noticed enlargement of abdomen for two years. First noticed that left side was slightly larger than the right. For past few months has had a sensation of fulness. No pain at any time. Patient is 5 feet 2 inches in height; weight 164 pounds. Somewhat anæmic. Skin is very flabby. Examination of thorax is negative.

Abdomen.—The distention of the abdomen is symmetrical upon inspection. On palpation through the thick and resistant abdominal wall, one can detect, indistinctly, a tumor about the size of a child's head. Percussion gives dulness from umbilicus to the symphysis and extends more to the left than to the right side.

Vaginal examination shows the uterus high in the pelvis and larger than a senile uterus should be. Adnexa cannot be palpated. High in the abdomen, being reached with difficulty, a tumor can be felt, having no direct connection with the uterus. The examination, owing to the thick abdominal walls is unsatis-

factory. Urine negative. Blood: Hæmoglobin 75 to 80 per cent.; erythrocytes 3,600,000; leucocytes 9,800.

Operation, March 6, 1903, by Dr. McAlester. Median incision. At this point the cyst is adherent to the parietal peritoneum. The wall of the cyst is extremely thin and through the manipulation is ruptured. From it there escapes a large quantity of a mucoid substance. Palpation is continued by placing the hand in the cyst cavity. The cyst is found adherent to the abdominal viscera from the liver to the pelvis, practically filling the abdominal cavity. Just above the uterus is noted a number of small cysts, making a mass about the size of a foetal head. It is this which was felt upon vaginal examination. The large cyst, filled with the gelatinous substance, had not been palpated. Cyst is drained with gauze and tubes. Peritoneal cavity as such is not opened.

Following the operation the patient was nauseated for a few days. She refused absolutely to take food and expressed the desire to die. Showed great mental depression. She finally died of exhaustion on March 16, thirteen days after operation, having run practically an afebrile course.

Autopsy by Dr. Miller. Abdominal findings alone are of interest. Median incision extending from the symphysis to the umbilicus. Through the lower half drainage of gauze. Upon removal of same a gelatinous substance exudes. When the abdominal cavity is opened this same substance is found adherent to the peritoneum practically throughout. Visceral peritoneum markedly injected.

The tumor is removed from the cavity along with the pelvic viscera. All viscera of the abdomen are adherent through the medium of the gelatinous substance. Rectum and bladder are normal.

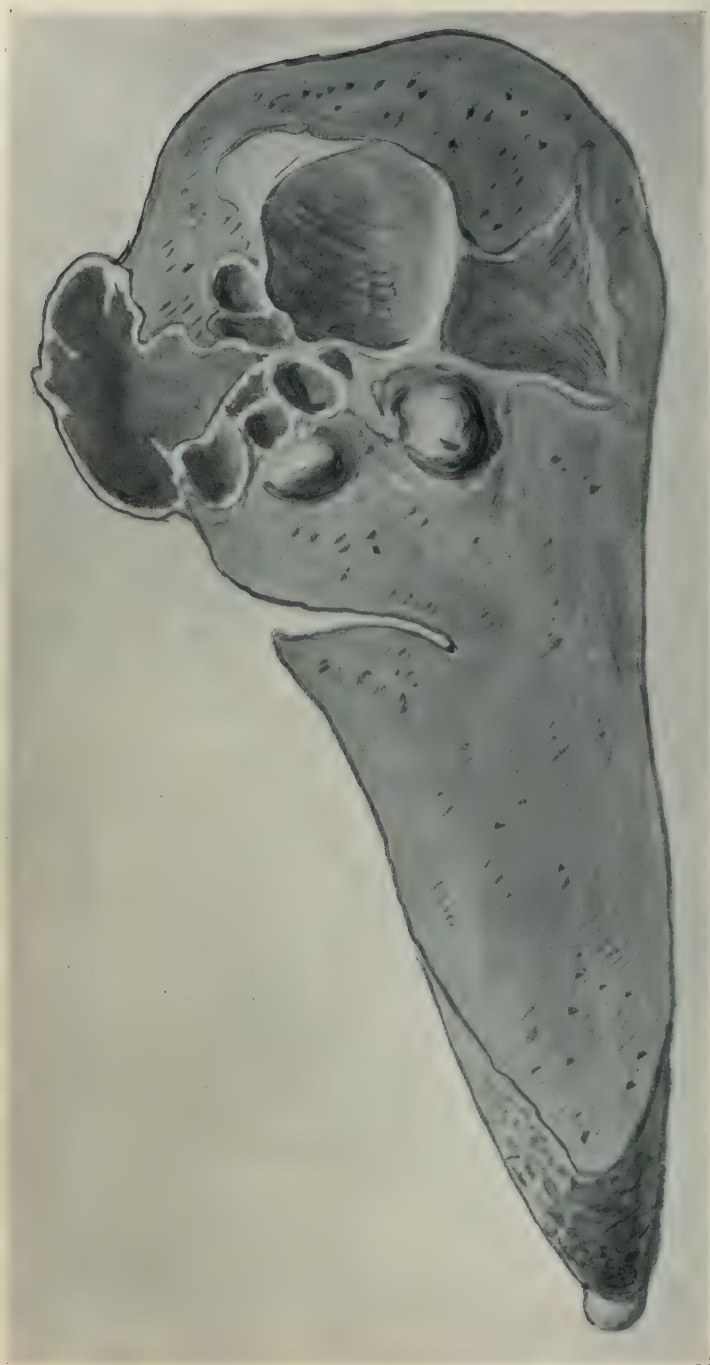
The uterus is large for a senile uterus. Its peritoneal surface is covered by a shaggy grayish-red fibrinous coat. The right ovary, round ligament and broad ligament are beset with small clear cysts and a delicate fibrinous exudate. The left tube at its abdominal end is swollen, and the vessels are injected. The ovary of that side cannot be distinguished from the tumor mass. On the left tube, and surrounding it, is a mass made up of small cysts measuring 4 x 8 x 2.3 cm. This mass is continuous with the main tumor, which measures 25 x 25 x 8 cm. and weighs 2,400 grams.

FIG. 1.



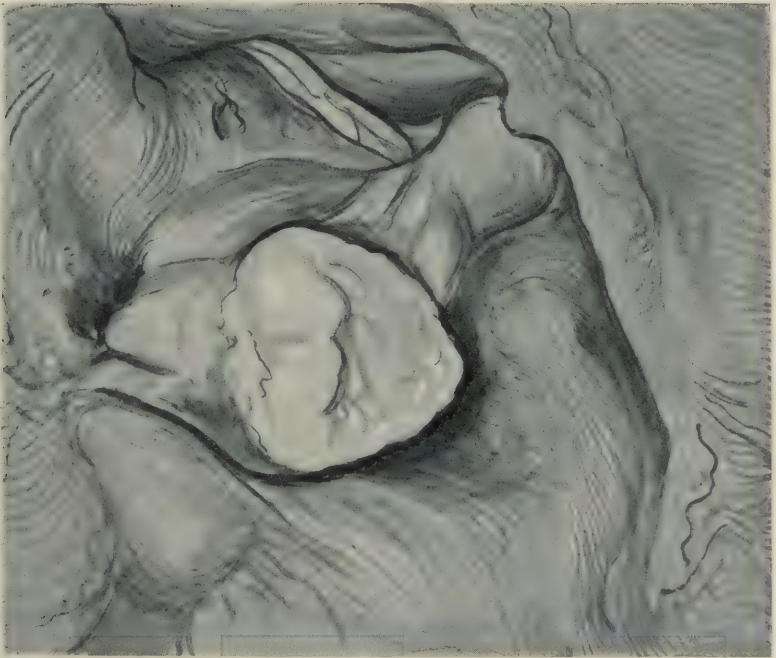
Spleen.—Showing involvement of entire pole of spleen by cysts.

FIG. 2.



Spleen.—Section through spleen, showing the encroachment upon splenic tissue by the cysts.

FIG. 3.



Cæcum showing dilatation of appendiceal opening and the escape of the pseudomucin into the bowel.

The tumor shows several perforations on its anterior aspect and from them this jelly exudes. The edges of the cyst wall at the point of perforation are everted. At the opening in the cyst wall made by the knife, the gelatinous substance is covered by a fibrinous exudate. The cyst is multilocular. The peritoneum of the anterior abdominal wall is covered with a shaggy grayish coat intermixed with the jelly. The peritoneum of the posterior cul-de-sac contains a number of small cysts and free pseudomucin.

The left kidney is pale and deformed. On its posterior aspect is a cyst, probably a retention cyst. The right kidney has an adherent capsule. The kidney substance is granular and the cortex pale.

Liver measures $25 \times 17 \times 7$ cm. The surface is covered in great part by the gelatinous substance. The right lobe is greatly constricted and reduced to a mere fibrinous band from which it is suspended. On section it is of a pale color and the lobes are indistinct.

Spleen is fairly imbedded in this gelatinous substance. It is irregular in shape, due to the growth of a cystic tumor (Fig. 1). Spleen measures $11 \times 5.5 \times 4$ cm. On section it is found to contain cysts (Fig. 2) measuring 5×2.5 cm. The contents of these cysts are the same in appearance and consistency as the primary tumor. The cyst has grown directly into the splenic tissue, destroying the latter in its growth. Trabeculæ and Malpighian bodies are conspicuous in the much reduced splenic tissue. Weight of spleen 130 grams.

Large intestine: Cæcum. At the ileocæcal valve, corresponding to the region in which we would expect to find the appendix, is a large tumor mass, measuring $4 \times 3 \times 4$ cm. Careful dissection fails to reveal the appendix, which is in all probability involved in the tumor mass. On the external surface the tumor, which is cystic, has ruptured at several points and from these this same gelatinous substance exudes. The cyst is not limited entirely to the cæcum, but a small daughter cyst about the size of a walnut has grown between the layers of the wall of the ileum, as is also true in the cæcum. On the mucous surface of the cæcum, a little below and external to the ileocæcal valve, is an opening (Fig. 3) measuring 1.5×2 cm., from which this same gelatinous substance escapes. The opening has a perfectly regular border, presenting a very different picture in this respect

from the rupture on the ascending colon, and seems to be a mere distention of the normal appendiceal opening. A section through the entire tumor mass shows it to be a multilocular cystic tumor with the same microscopical appearance as the original tumor. Twenty-five centimeters above this point on the ascending colon, corresponding to the hepatic flexure, is a perforation of the colon on the anterior internal band. It measures 2 x 2.5 cm. on the mucous surface. The border of the perforation is very irregular and shows small pieces of gelatinous substance adherent to same. Most of the cystic contents have been lost. The peritoneal surface of the cyst also shows rupture. The escape of fecal contents was prevented by the presence of the gelatinous substance. A distinct cyst wall can be noted in the upper area and is of harder consistency than the remainder of the cyst wall. The wall of the intestine appears infiltrated.

Microscopic Examination. A number of pieces from the original tumor, omental and peritoneal metastases were taken for examination. The findings correspond in every detail to the cases commonly described—being a simple pseudomucin cystadenoma.

Spleen.—As can be recognized macroscopically, the metastatic cysts penetrate deep into the unchanged splenic tissue. No round-cell infiltration. The structure of the cysts is the same as in the metastatic cysts in other parts and as the mother cyst. With few exceptions, the cyst contents, taking a typical pseudomucin stain, is separated from the splenic tissue by the connective tissue capsule of the cyst, with or without its epithelial lining. At some points the entire cyst wall is broken through and the gelatinous substance is found in direct contact with the splenic tissue.

Large Intestine.—Pieces were taken from the cæcum and ascending colon at the points of perforation. The cysts are found to penetrate the layers of the intestine. There is a very slight round-cell infiltration. The mucous membrane, as well as the other layers of the intestine, do not take the stain well; but the nuclei of the cells can be recognized and no distinct degeneration is noted. The connective tissue layer of the cyst wall, in contrast to the tissue of the intestine, takes a pronounced stain. The epithelial lining of the cysts is for the most part lost. At points the gelatinous contents has broken through the capsule. Several pieces taken from the supposed opening of the appendix into the bowel, fails to reveal the mucous membrane on either surface.

In this case, a very rare condition has been observed in the spleen, cæcum and ascending colon. We find a process which has not hitherto been described, except in one case. This class of tumor has always been regarded as non-malignant; but

for such pathological conditions a new subdivision must be made. Polano reports a case which shows a somewhat similar process in the liver, but even here the same degree of malignancy does not exist. The cystic growth had penetrated deep into the liver along the connective tissue of the portal vein. The vessels themselves were not involved. The microscopic examination reveals an intact capsule of Glisson. These cysts show the same structure as the peritoneal and omental metastases. The boundary between the new growth and the liver cells is formed by cyst epithelium and connective tissue. At several points the capsule is broken through and the gelatinous substance is found in the liver parenchyma.

The class of metastases noted by Olshausen, in which cysts with the same structure as the mother cysts have been implanted upon the peritoneum and omentum, has been frequently noted. In no case, however, has the intact peritoneum been destroyed or viscera penetrated.

In the case of Palano, the cells of the mother cyst followed the connective tissue of the portal vein. This process in itself is not so remarkable, for we have similar processes in the cases of Baumgarten, Sanger and Peiser, in which following the use of the trocar, metastatic cysts developed along its tract or developed in an old abdominal scar. The microscopic examination in Polano's case reveals in places a penetration of the liver tissue by the cysts, and it is this which most naturally makes one think of malignancy.

The spleen in my case shows even a different process. Here the cyst has developed upon an intact peritoneum, has penetrated it and destroyed the splenic tissue. True, the metastatic cysts have not developed in distant organs through the medium of the lymphatics and blood vessels, but this is not the only test of malignancy. There is a similar process in the malignant growths of the stomach, with metastases in the ovaries, as a result of direct implantation, as shown by Krause and others. We are accustomed in all malignant processes to see direct implantation.

The process in the cecum and ascending colon represents

a similar malignant condition. At first glance one might regard the perforation of the bowel as the result of a direct pressure necrosis, but the microscopic examination removes all doubt on this score. Sanger reported the first case of perforation of the intestine. He regarded it as the result of pressure atrophy. Peiser reports a case with two perforations and offers a similar explanation. In his case, the tumor became infected, forming firm adhesions to the intestines and parietal peritoneum, so that the intestine could not escape the pressure from the growth of the tumor. Upon examination the microscope failed to reveal any growth of the cyst into the serosa, muscularis or mucosa.

In the case of Martin, recently reported, there was a perforation of the bladder and rectum and fistulous openings in the ileum and sigmoid. There was an absence of any infection of the cyst. Microscopic examination of the bladder and rectum demonstrated a gradual thinning of the walls up to the points of perforation. Active process in the walls was not noted. The tumor, fixed in the pelvis, developed adhesions to the surrounding viscera and exerted a constant pressure against the pelvic wall. The fistulous communication between the cyst and ileum and sigmoid were inflammatory, probably due to an infection by the bacillus coli.

The explanation offered in the previous cases, will not hold true in my case. We have here an active process. The pseudomyxomatous cysts have become implanted upon the intestine, destroyed the wall by an active process and thus produced the perforation.

The involvement of the appendix and cecum is such that a differentiation of the parts is impossible. All that can be said is that the appendix is involved, possibly primarily, and from this the cecum and ileum have become affected. Westphalen reports a case in which the appendix is distended into a sausage-shaped tumor, 16 cm. long and 7 cm. thick, through which the gelatinous substance can be seen. Microscopically small pseudomucin cysts are seen within its lumen and at places within its wall. The appendix is distended with jelly and is

shut off from the cæcum by a membrane, probably the result of a previously existing atresia. Westphalen regards this as an implantation metastasis.

Fränkel has observed a case of true myxomatous degeneration of the appendix, without any similar process in the ovary or other viscera.

We have in this active destruction of the spleen and intestine a pathological process, differing from the three processes collected by Strassman. An ovarian cyst, regarded ordinarily as a benign type, produces typical implantation metastases, with the destruction of the tissue upon which they are implanted. This picture we are accustomed to recognize as a malignant process, and should be so accepted in this case. In Polano's case, which did not begin to show the same extent of destruction of tissue, attention was called to the necessity of recognizing another class of these metastases. He has dignified it by the name "*Cystadenoma malignum pseudomucinosum peritonei*," to differentiate it from the simple type without destruction of tissue or penetration of intact epithelium. These cases should serve to emphasize the necessity of recognizing the malignancy of a few of these tumors.

The second case has a typical history of rupture of the cyst with non-malignant metastases.

CASE II.—Miss G.; age sixty-five years. Admitted to the hospital April 25, 1904. Was seen in consultation the following day. Patient comes to the hospital on account of an enlargement of the abdomen. Has had epilepsy all her life. This has left her quite an invalid and has greatly impaired her mind. About three years ago she had what was diagnosed by her physician as peritonitis with effusion. Was very sick but made good recovery. About two months ago she noticed that the abdomen was larger than usual. Paid little attention to it at first, but it grew so rapidly that she finally called a physician. This was about one month ago and since this time the abdomen has increased $1\frac{1}{2}$ inches.

Examination.—Thorax negative. Abdomen prominent; 37 inches in circumference; tympany in flank; dull below umbilicus

in median line and to the left; nothing palpable; at times one thinks he notes fluctuation. Vaginal examination negative. Urine: Trace of albumin and hyaline casts.

Examination under an anæsthetic reveals a tumor of the right ovary the size of a double fist. It is very high in the abdomen and barely palpable from below. It requires a bimanual examination before it can be recognized.

Diagnosis.—Ovarian tumor; chronic epilepsy; dementia.

Operation was refused. Death occurred May 23, the immediate cause being hæmorrhage from the stomach. During ten days before her death she suffered from repeated hæmorrhage, and also passed blood by the bowels.

Autopsy by Dr. Miller.—Upon opening the abdomen, there was removed from its cavity a large quantity of gelatinous substance. This comes from a ruptured cyst of the right ovary. The cyst was a multilocular one, with a comparatively small pedicle. On both the parietal and visceral peritoneum firm union of the gelatinous substance was noted.

Lungs and heart negative, except for adhesions of the right pleura.

Spleen.—Capsule thickened. Adherent to omentum, stomach and diaphragm.

Liver somewhat smaller than normal and surface granular. Gall-bladder distended and contains several small stones. Ducts free. On cut surface of liver a marked increase of connective tissue was noted.

Kidneys.—Small, lobulated and surface granular. Capsule adherent. Cortex shrunken. Several small retention cysts.

Intestines normal. Omentum contained number of small cysts.

Œsophagus.—The lower end of the œsophagus contained a great many dilated veins and several ulcers size of a pea. It was from this area that the hæmorrhage occurred. Ulcers were several inches from the cardiac end of the stomach.

Stomach negative. Arteriosclerosis quite marked. Uterus atrophic. Left ovary size of almond, sclerotic and atrophic. Small cysts on broad ligament.

Diagnosis.—Pseudomucin cystadenoma of the right ovary, with rupture. Pseudomyxoma peritonei. Chronic interstitial nephritis. Ulceration and varicose condition of veins of œsophagus. Splenitis.

In none of the cases of pseudomyxoma peritonei was a diagnosis made before the operation, except in a few in which the trocar had been employed. There seems to me to be a complex of symptoms, which if carefully noted, make it possible to diagnose both the nature of the tumor and the rupture.

In some few cases it is possible to have symptoms which indicate the exact time of the rupture; but this is the exception. If the case has been previously observed and a diagnosis of tumor made, it would easily be possible to diagnose the rupture from the apparent changes. These cases are usually not seen until the rupture has occurred.

I find a few cases recorded, in which the patient reports having had an acute attack of pain in the abdomen, general tenderness, nausea and vomiting. Following these a rapid growth of the abdomen was observed. This latter condition is of great diagnostic value, for in all cases careful histories will show a very rapid and pronounced increase in the size of the abdomen, extending over a period of not more than a few months in any case. This growth is more pronounced than in any of the abdominal tumors, save those in which a malignant degeneration exists. The probable explanation of the rapid increase in the size of the abdomen, is the abundant secretion of the pseudomucin, made possible by the relief of the pressure on the secreting cells of the cyst.

Symptoms of peritonitis are sometimes present, but always without noteworthy temperature. Usually dating from the period of rupture and rapid growth, there is noted emaciation, anorexia and occasional disturbance in the bowels, either a constipation or diarrhoea. These symptoms may all be accounted for by the disturbance of the absorptive function of the intestinal tract, as a result of the blocking of the lymphatics.

Upon inspection, a rather symmetrical increase is observed, since the gelatinous substance is distributed throughout the peritoneal cavity. The abdomen is broader than high, not having the barrel shape ordinarily found in large tumors; the shape being more like that of free ascitic fluid. The epigastric region is distended equally with the hypogastric and umbilical

regions, a condition not ordinarily found in pelvic tumors. This is to be explained by the constant collection of a large amount of gelatinous substance in this region.

Palpation offers the most characteristic signs. The palpable tumor is frequently so small that it is recognized with difficulty, especially in those cases with thick abdominal walls. The size of the tumor does not correspond with the pronounced symptoms and especially not with the rapid growth of the abdomen. Rarely is there found a palpable tumor larger than a foetal head. Ovarian cysts of this size, one is accustomed to find in the pelvic canal. In these cases they are usually found high in the abdomen; sometimes so high that it is impossible to reach them through the vagina. This is very important as a diagnostic sign.

The general contour of the tumor if large is irregular, making a diagnosis of a multilocular growth possible. The "Kolloidknittern" of Olshausen, due to the escape of the colloid substance from one cyst cavity to another, may be observed. Pfannenstiel does not regard this symptom of value and claims to have found it with a fibroid and with a distended bladder.

Fluctuation is uncertain, and it is just this uncertainty which makes it of diagnostic value in some cases. We might call it a pseudo-fluctuation. When present it is a large wave and usually disappears entirely by breaking the wave with the hand. I find in a number of cases this symptom is noted and in each case the uncertainty of the fluctuation is commented upon. At times when one strikes in such a way as to get just the proper motion of the jelly, a true fluctuation is noted; while again repeated attempts fail to produce fluctuation, even though the patient has not changed her position. The rupture of the partition walls of the cysts, described by Olshausen as giving the "Kolloidknittern," may be a factor in determining the presence or absence of fluctuation.

Auscultation offers little, except in occasional cases the "Kolloidknarren" of Oldshausen may be detected.

On percussion there is dulness in the lowest points and a dull tympanitic note in the epigastric region. In no case do I

find record of complete dulness in the epigastrium. Upon changing the position of the patient, the dulness does change, but as a rule only slightly. At times small areas of dulness are found in the middle of the abdomen, with distinct areas of tympany around them. Distinct tumor outline can rarely be percussed. The percussion signs simulate those in general of an encysted fluid in peritonitis, but the distinction can readily be made, in that none of the other symptoms of such a peritonitis exist. The general dulness is always greater than the palpable tumor would permit one to expect.

The vaginal examination may assist in confirming the abdominal findings. The height of the tumor in the abdomen is especially noteworthy. In a number of cases this was noted, in that the tumor could scarcely be palpated by the bimanual examination. In our second case, an anæsthetic was necessary before the tumor could be recognized, either by abdominal or vaginal examination. Even in those cases in which the rupture occurs in the cephalic pole of the tumor, it tends to take this high position, unless prevented by an intraligamentous growth or adhesions. In some cases the gelatinous substance, which always fills the posterior cul-de-sac, can be palpated by vaginal examination.

The recognizing of the pseudomucin in the stools might be possible in those cases with perforation of the bowels.

The negative findings with the trocar, should one still persist in its use, would be of value.

The following scheme will show the points of distinction in the differentiation of ovarian cysts and the pseudomyxoma peritonei:

Ovarian cyst.

*Pseudomucin cystadenoma with
rupture*

No general symptoms.

General symptoms.

Slow growth of abdomen.

Rapid growth.

No pain, unless torsion of the pedicle.

Pain usually at time of rupture.

No peritonitis, unless torsion of pedicle,—when all symptoms of peritonitis are present.

Some symptoms of peritonitis. No temperature.

Inspection of abdomen:

- a. Asymmetrical unless the entire abdomen is filled by cyst.
- b. Abdomen rounded. Flat in flanks with patient in recumbent position.

Percussion:

- a. Dulness over abdominal prominence only.
- b. Tympany in flanks and epigastrium.
- c. No change in percussion with change of position.
- d. Fluctuation.

Palpation:

- a. Tumor can be outlined by palpation.
- b. Regular contour.
- c. Tumor in pelvis when small.

Auscultation:

Negative.

Vaginal examination.

- a. Tumor readily palpable.
- b. Negative.

Exploratory puncture positive.

Inspection of abdomen:

- a. Symmetrical.
- b. Abdomen flat, bulging in flanks.

Percussion:

- a. Dulness not in proportion to size of tumor.
- b. Dulness in flanks, reduced tympany in epigastrium.
- c. Change.
- d. Pseudo-fluctuation.

Palpation:

- a. With difficulty.
- b. Irregular.
- c. Palpable portion high in abdomen.

Auscultation:

"Kolloidknarren" of Olshausen may be present.

Vaginal examination:

- a. Palpated with difficulty.
- b. Pseudomucin sometimes palpable in cul-de-sac.

Exploratory puncture negative.

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PRIMARY TYPHLITIS WITHOUT APPENDICITIS.*

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THE prevalent surgical teaching, that practically all acute, inflammatory conditions in the right iliac fossa are due to appendicitis, led the writer to make a grave error in diagnosing the conditions present in a patient the details of whose case will be related later. This teaching was so deeply fixed that even after the abdomen had been opened, a correct diagnosis was not formulated. The result of this error was so fraught with disaster to the patient that I resolved to investigate the question of whether an acute primary inflammation of the cæcum (typhlitis) occurs independently of any lesion of the appendix. We naturally exclude, from such an inflammation of the cæcum, the specific diseases of typhoid, dysentery, actinomycosis, tuberculosis, etc. By this typhlitis is meant a primary, localized inflammation of the cæcum which begins in the mucosa and which may go on to ulceration and perforation. The subject has been the origin of much controversy and a consideration of the views of different authors brings up many conflicting opinions. The results of my researches in regard to this topic are set forth in the following pages. I shall quote the opinions of many authorities both pro and con, together with the recorded cases of the past seven years, and shall endeavor by the evidences thus set forth to arrive finally at some conclusions as to two definite questions:

1. Does a primary, non-specific typhlitis occur without prior involvement of the vermiform appendix?
2. Does appendicitis follow such a primary typhlitis?

In the Pathology by Delafield and Prudden, 1901, is the following: "Catarrhal inflammation of the cæcum is not uncommon. It is usually produced by an habitual accumulation of

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fæces in this part of the intestines. The course of the inflammation is usually chronic but marked by acute exacerbations. At first the mucous membrane undergoes the ordinary changes of chronic catarrhal inflammation. To this may succeed a slow suppurative inflammation which extends through the wall of the intestine and gives rise to ulcers and perforations."

Osler (Practice of Medicine) dismisses the subject of typhlitis with these few words: "With rare exceptions we know that the cæcum is not affected and even the condition described as stercoral typhlitis is in reality appendicitis." He, however, in another place records two cases of perityphlitic abscesses following ulcerations of the cæcum.

In the Text-Book of Pathology by Alfred Stengel, 1906, is the following: "Typhlitis or cæcitis may be due to the irritation of the intestinal contents in consequence of constipation (stercoral typhlitis). This affection is probably very frequent, though it leads to no severe consequences and occasions no urgent symptoms. Typhlitis is probably generally of the simple, catarrhal variety, but in obstinate constipation or obstruction of the colon, ulceration may occur. Perforation or extension to the surrounding tissues (perityphlitis) is the rarest of all consequences. Usually the latter is secondary to inflammations of the vermiform appendix. Appendicitis may result from primary typhlitis. The inflammation of the mucosa of the cæcum may extend directly to that of the appendix, or may cause obstruction of the mouth of the appendix in the same manner as duodenitis causes obstruction of the common bile duct."

Tyson (Practice of Medicine, 1906) says: "Modern studies go to show that true appendicitis almost never begins in the cæcum but that in essentially all cases the appendix is the root of the evil. Inflammation and perforation of the cæcum are, however, possible events, though they are not clinically separable from appendicitis."

Rose and Carless in their Surgery state: "Appendicitis is not infrequently associated with a true typhlitis, probably due to a chronic constipation. The continuity of the mucous

lining of the cæcum and appendix explains this fact, which must always be taken into consideration in estimating the benefits which may be expected from removal of the appendix. Much disappointment in the non-relief of symptoms has arisen from the persistence of the typhlitis after the appendix has been removed."

Sir Frederick Treves, in Albutt's System of Medicine, says that he claims for the stercoral ulcer a definite position in the production of perityphlitis. Precisely similar ulcers, and in the same way, are produced in the appendix by the lodgment of little masses of fæcal matter in the tube. The long impacted fæcal masses in the cæcum cause catarrh which in turn gives rise to the spurious diarrhœa often seen, and this catarrh often passes on to ulceration, and if this is sufficiently deep to allow the peritoneum to be infected, then perityphlitis results, and to produce this condition it is not necessary that the cæcum should be actually and freely perforated. Finally, it must be allowed that the appendix is frequently infected from a diseased cæcum. He describes a case of perityphlitic abscess which was opened and the appendix seen to be normal in every particular. He says that the stercoral is the most common ulcer of the cæcum leading to perityphlitis, and that the dysenteric does not seem to lead to it.

Charles B. Lockwood's book on Appendicitis, 1906, contains no reference to inflammation of the cæcum that I could find. He cites two cases, however, of fæcal impaction of cæcum after appendicitis operations which caused almost similar symptoms as before the operations.

Bayard Holmes, in his book on Surgery of the Abdomen, 1904, Part I, Appendicitis, does not mention typhlitis. The same is true of Morris on Appendicitis, also of Fowler in his Surgery, of the Handbuch der Praktischen Chirurgie, and of Park's Surgery.

Deaver, Appendicitis, 1905, expresses most positive views on the subject, as follows: "There lurks in the minds of a great many men, a persisting belief in a primary typhlitis,

whether idiopathic or stercoral, and some physicians, even at the present day, seem averse to the realization of the fact that it has been proved over and over again that the appendix is *always* the original seat of trouble in acute inflammations of the right iliac fossa. Stercoral typhlitis—an inflammatory condition of the cæcum the consequence of the irritant action of fæces retained within without extrinsic cause—does not occur and must be evident to all who have had experience. By some a series of cases presenting pain, tenderness, and a more or less soft tumor in the right iliac fossa, constipation, slight fever, etc., have been recognized as stercoral typhlitis—not that any one has ever described the anatomical lesions of stercoral typhlitis, but solely upon clinical assumption. Early operation in such cases has demonstrated the presence of catarrhal and interstitial appendicitis with serous or fibrinous peritonitis. The cæcum in such cases rarely reveals evidence of disease and such as does exceptionally occur is always less marked than is that of the appendix. That stercoral typhlitis may occur, I do not deny; that it does occur I do not believe.”

Ochsner expresses himself as follows: “There can be no doubt whatever in the minds of those who have had frequent opportunity to observe the pathological conditions present during the early part of the disease (inflammation of the right iliac fossa) by having operated during the first few hours after the beginning of the attack, that the disease always begins primarily in the appendix.”

McNutt, in the American System of Practical Medicine (Loomis-Thompson) observes: “While clinically it is not always possible at the present time to differentiate between appendicitis and cæcitis, pathologically they must not be confounded. The fact that appendicitis is a much more frequent disease is no reason for ignoring the pathology of cæcitis. It is very doubtful whether catarrhal inflammation of the cæcum is so much less frequent than catarrh of the appendix. That ulceration, perforation and gangrene are less frequent in the cæcum is, of course, well established. Surgical operations and post-mortem examinations on cases that have been diag-

lining of the cæcum and appendix explains this fact, which must always be taken into consideration in estimating the benefits which may be expected from removal of the appendix. Much disappointment in the non-relief of symptoms has arisen from the persistence of the typhlitis after the appendix has been removed."

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carefully observed, if the local physical signs were minutely noted from day to day, and, above all, if sufficient importance were attached to the condition of the bowels. It will be seen by consulting the scanty information afforded in these records, that diarrhoea, dysentery and hæmorrhages were prominent features in several of the cases. Coeliotomy is the proper treatment."

So much then for the opinions of various writers. It remains to examine the recorded cases to see what evidences we have for our belief in the existence of a primary typhinitis.

Kelly in his book quotes in detail fourteen cases presenting primary lesions in the cæcum, the appendices being normal. A number of these cases showed perforations of the cæcum with a general peritonitis. (For details see his work.)

Nauwerk (*Münch. medizinische Wochenschrift*, 1901, 47, p. 1901) says that he believes that the views of many surgeons that stercoral typhinitis does not exist are erroneous. He exhibited the cæcum of a man, 78 years of age, who had suffered from constipation and who died of general peritonitis. The cæcum showed circumscribed, perforated ulcerations which he attributed to coprostasis.

Bozzi (*La Clinica Chirurgica*, 1904, iii) reports a case in which the examination and the history made the diagnosis of appendicitis probable. At the operation no appendix could be found after exhaustive search and there were only a few, loose adhesions in the cæcal region. He concludes: 1. That typhinitis occurs and is an independent affection. 2. That the appearances of typhinitis are the same as those of typical appendicitis. 3. That typhinitis has a considerable place in the etiology of appendicitis.

Reisinger (*Münch. medizinische Wochenschrift*, 1903, No. 40) in 350 cases of perityphinitis, operated on in the Krankenhaus in Mainz, found two in which the cæcum alone was diseased.

The first patient was a man who was admitted with the symptoms of most acute perityphinitis—high fever, vomiting, distention, cessation of passage of stool and flatus, great tenderness and dulness over the appendix.

At operation a large abscess was found between the parietal peritoneum and the cæcum. The base of the abscess was formed of gray intestinal wall. Tamponade. This gray part of the intestinal wall subsequently sloughed and a fæcal fistula established itself. Later several operations were undertaken to close the fistula and in one of them the appendix was found without adhesions and perfectly normal. Patient before the operation was free from tuberculosis and had never suffered from constipation.

The second case was in a woman of thirty-seven years of age who had had frequent attacks of obstinate constipation, for which she used laxatives and enemata freely. One attack was more severe than usual and more prolonged, and after four days she was brought to the hospital with the symptoms of general peritonitis. Operation revealed free, foul, fæcal pus in the general cavity and a grayish-black cæcum with two perforations in its wall, and with the lumen filled with fæcal masses. Its walls were very friable, the mucosa much damaged. The appendix lay in the normal position. It was slightly thickened and its surface red, as was to be expected from its proximity to an acute, intestinal gangrene. Resection of the gangrenous area and suture. Death after twenty hours. Autopsy revealed no stricture of the colon or rectum. The cæcum was as described and its vessels thrombosed. The inner surface of the appendix was in all respects normal.

He makes the remark that in cases of enormous fæcal impaction, causing ulcers and gangrene, these latter almost always involve the cæcum, and that it is extraordinary that in these instances the transverse and descending colons show no signs of ulcers in their mucosæ, even when the sigmoid and rectum are strictured. In two of his cases with strictures of the rectum, operation showed gangrene of the posterior wall of the cæcum and perforations. He explains this partially by the fact that the cæcal walls are thinner and weaker than any other portion of the large intestine, which allows greater stretching and distention, in which process the mucosa is exposed to more or less severe injury by pressure. To these factors must be added the element of infection, producing thrombosis of the vessels, etc.

SICK (*Deutsche zeit. f. Chir.*, 1903, vol. lxx, p. 591) reports a case of acute typhlitis where the diagnosis of acute appendicitis was made. The onset was sudden, five days prior to the operation, with chill, fever, distention, tenderness, pain, resistance and tumor in the right iliac fossa. At operation the appendix was found normal, the cæcum filled with hard

faecal masses, and on its lower anterior wall a bean-sized spot where an ulcer was about to perforate. Invagination of the ulcer. Recovery.

Lanz (*Beiträge zur klin. Chir.*, 1903, vol. xxxviii, p. 56) in an article on the pathology of appendicitis contends for the existence of a primary typhlitis which extends to the appendix later. To the objection why surgeons in their numerous appendectomies, do not oftener see changes in the cæcum he replies that the conditions tending to the recovery of the cæcum are much more favorable than those in the appendix, and that sometimes when we remove the latter the cæcum has already recovered. He cites a case of primary typhlitis which began with colicky pains, diarrhoea, fever and local tenderness in the right iliac fossa. On the third day an ileo-cæcal tumor developed. At operation the cæcum was found to be very thick and inflamed and the appendix to be normal.

Jordan (*Archiv. f. klin. Chir.*, vol. lxi, p. 531) gives a case of simple, localized primary typhlitis in which there was an exact microscopic examination of the cæcal wall during or soon after an attack and, in addition to which, there was an examination of the normal appendix. His case is so similar in many respects to my own case, detailed later, that I shall report it fully.

A ten-year-old girl was taken ill with typhlitis, with fever and pain, and in a short time a growing exudate, a hand's breadth in size and tender on pressure, appeared in the cæcal region. The exudate could be felt by rectum. The inflammation seemed localized and there were no serious general disturbances. The induration subsided somewhat and the general condition remained good, though obstipation persisted, and on bowel movement there were pains in the cæcal region. The diagnosis was made of an acute appendicitis in the stage of diminution, with perhaps an appendix containing pus and imbedded in lymph. Operation six weeks after the onset. The cæcum was found in the midst of inflammatory adhesions, on separating which the appendix was discovered, free and with intact surface. This latter was removed and was found normal except for a faecal concretion, the size of a pea. On freeing the cæcum, a brawny area of infiltration, corresponding to an adhesion on its anterior surface, the size of a fifty-cent piece and 0.5 cm. thick, was found and excised. Edges of wound sutured with silk. The resected area lay below the level of the ileum and about 0.5 cm. to the outside of the resected appendix. Drainage of the abdomen. Rapid recovery. The piece

of cæcal wall removed was 3 by 2 cm. in size and on its mucous surface there was a superficial ulceration, 2.5 cm. in length and 0.5 cm. in maximum breadth. The surrounding mucosa was swollen. Microscopical examination showed no evidences of tuberculosis, but an extensive, small-celled infiltration, most marked in the mucosa and submucosa. In the infiltrated zone, staphylococci were seen. The case, therefore, presented a simple, primary acute typhlitis with perforation, which in its clinical course as well as in its anatomical details corresponds to the classical picture of a stercoral typhlitis.

Thomas (*Therapeutic Review*, Phila., Oct., 1904) writes an article on the relation between typhlitis and appendicitis. He reports two cases.

CASE I.—A woman, sixty-two years of age, had had for three weeks a persistent diarrhœa, with tenesmus and occasional vomiting. Before the diarrhœa began she had been constipated obstinately for a long time, frequently going four or five days or a week without a bowel movement. Pain in the right iliac region had been present from the beginning. On admission the temperature was 101°, pulse 90, and she was vomiting at intervals. She was distended and the tenderness in the region of the cæcum was so marked that she cried out when the abdomen was touched. The diagnosis of acute appendicitis was made and she was operated upon the next day after admission. The entire cæcum was found very much inflamed and the appendix seemed to be normal. Later, on section of this latter there was found no sign of inflammation. The cæcum, about 2 inches from the base of the appendix, seemed to threaten perforation. Drainage. Recovery.

CASE II.—A case was operated upon in the hospital, at which time it was found that the appendix had been removed at a previous operation, and the inflammation was due to ulceration of the cæcum.

FELTZ ("Chronic Typhlitis," *Gaz. Hebdom. de Med. et de Chir.*, 1902, Jan. 23, p. 74) gives the following case: A woman, forty-four years of age, was admitted to the hospital with the diagnosis of intestinal obstruction. For the preceding six months she had had attacks of colicky abdominal pain, which was not localized, and distention, with alternating diarrhœa and constipation. The diagnosis was made of chronic enteritis which had caused a narrowing of the intestinal canal. Following the giving of a laxative, there were two liquid movements, but during the next morning there were chills, very violent pains, tenderness, and rigidity in the right iliac fossa, together with increased temperature and pulse rate. Death occurred the next day, the diagnosis being peritonitis from intestinal perforation. Autopsy. Cæcum extremely distended, its walls very thin, particularly in the upper region, where the thickness in one place is reduced to that of a leaf of paper, at which level there is a small pus focus in communication with the perforation. The remaining intestine is normal. The appendix is normal in every respect. The cæcum

is filled with faecal masses of the consistency of mastic, and intimately glued to the caecal walls. The writer of the article thought that the perforation had probably been produced by the increased peristalsis caused by the laxative, prior to which there had been a typhlitis present.

Hemmeter (*Diseases of the Intestines*, 1902, p. 19) writes the following: "Numerous publications have given evidence to the fact that the caecum may really be primarily affected and be the seat of ulceration and perforation whilst the appendix is apparently normal. These are instances of genuine typhlitis pure and simple. I have observed two cases in my experience in which typhlitis was due to the perforation of a caecal ulcer and the appendix was normal at necropsy. The exact relation as to how many cases of caecal and pericaecal inflammations are in the caecum itself and how many have originated in the appendix will always be more or less conjectural. According to Maurin, who studied 136 cases of sup-puration of the caecal region, 95 were exclusively lesions of the appendix, 6 had started from the caecum and the appendix, and 35 had involved the caecum alone. According to the obser-vations of Porter, Curschmann, Deutschmann and Kronlein, the occurrence of primary typhlitis can not be doubted. While admitting the extreme rarity of such conditions, we can, however, not entirely deny the existence of a simple, primary typhlitis, independent of involvement of the appendix."

Leube (*Medical Diagnosis*, 1904, p. 311) says: "It is well known that inflammatory diseases are very frequent in the right iliac fossa. It was formerly believed that they originated in the caecum and were the results of an inflamma-tory catarrhal process due to stagnating faecal masses (typh-litis stercoralis) and from thence the inflammatory process would spread, with or without the formation of pressure ulcers, from the caecum to the adjacent peritoneum (perityphlitis). This view has recently been entirely abandoned, as post-mortem examinations, and especially the early operations which were undertaken to subdue these inflammatory conditions, have proved conclusively that their origin is to be found in the caecum only in the rarest instances, and that, moreover, more

than ninety per cent. of the cases originate in the vermiform appendix."

A further complication of typhlitis arises when as a result of the chronic inflammation with ulceration of the ileo-cæcal valve there is such a production of connective tissue that a stenosis is produced. The following cases illustrate this condition:

WILMANN'S (*Beiträge zur klin. Chir.*, 1905, vol. xlv, p. 221) operated upon a man who had had symptoms of chronic intestinal obstruction for two months. Resection of the cæcum, for a ring-like tumor which constricted the lumen at the ileocæcal valve. On examination the mucous membrane of the cæcum was ulcerated, the submucosa much hypertrophied, and the muscular coat almost entirely replaced by connective tissue. The cæcal wall was very thick and inelastic and the ileocæcal valve represented a hard, unyielding ring, the lumen of which was no larger than would admit a lead pencil. The appendix was adherent but its lumen was free, its mucous membrane intact, even to the blind end, and its walls not infiltrated. Microscopical examination showed no evidences of new growth or of tuberculosis, etc. Wilmanns attributes the inflammation without question to the irritation produced by the intestinal contents, to a stercoral typhlitis.

EINHORN (*Munch med. Wochenschrift*, 1891, p. 121, 140) mentions two cases in which the intestinal wall was very much thickened at the valve, so that a ring-like stenosis was produced. Tuberculosis was excluded.

BRICKNER (*Medical Record*, April 28, 1906, p. 691) reported the case of a man of forty-six who had had attacks, the symptoms of which made probable a diagnosis of chronic appendicitis, complicated with some possible obstruction. At the operation, which resulted fatally, the cæcum was found much thickened, the seat of extensive and numerous ulcerations, and with a retrocæcal appendix, which was obliterated at the tip and which contained a drop of pus at its thickened base. Resection of 3 inches of the ileum and 4 inches of the cæcum. Dr. Libman, Pathologist of Mt. Sinai Hospital, considered it to be a case of primary, stercoraceous ulceration of the cæcum, to which the changes in the appendix were secondary and unimportant, and that the symptoms were due to the recurrence of attacks of swelling of the cæcum and ileocæcal valve.

Nothnagel says in reference to the kinds of intestinal ulcers which give rise to cicatrices producing stenosis, that the most frequent and most important are the tuberculous and the *stercoral* ulcerations.

Reports are increasing of late of the disappointment

experienced in numerous instances in the non-improvement of symptoms after removal of the appendix for a supposed appendicitis. The persistence of an inflammation of the cæcum may help to explain some of these cases. Fischl (*Prager med. Wochenschrift*, 1904, No. vii., p. 82) writes an article on "Typhlitis after Amputation of the Appendix." He published five cases of operations in the interval for appendicitis, in which the following disease-picture was common: Constipation, often with scybalous masses in the cæcum, and in some cases alternating with diarrhœa, pains in the ileocæcal region, where there were resistance and tenderness, loss of appetite and finally vomiting, no elevation of temperature or small. At times it ran an acute course, with very severe symptoms, or in other cases it was milder and the symptoms were chronic in character. It had nothing to distinguish it from mild appendicitis and, had the operations not been performed, would have been so diagnosed and treated. He says these cases prove that a disease exists which presents exactly the same picture as appendicitis but yet without such an inflammation being present. One can only refer the symptoms to an inflammation of the cæcum.

The recent reports of Haberer (*Archiv fur klin. Chir.*, 1905, vol. lxxvi, p. 438), from von Eiselberg's clinic in Vienna, state that of ninety-six appendicitis operations in the interval, in only fifty of the patients were the symptoms entirely relieved by the operations. Forty patients continued to have more or less marked disturbances, such as obstinate constipation, severe pains amounting in some to attacks of colic, such as they had suffered prior to the operations.

PATHOLOGY.

In considering the importance of the cæcum in the development of inflammations in the right iliac fossa, we are compelled to admit at the outset that a satisfactory pathology of diseases of the cæcum has yet to be written. We may divide primary typhlitis into two general classes: I. Certain specific, ulcerative processes, such as actinomycosis, typhoid, dysentery, tuberculosis, and cancer, which may all

lead to perforation. To these may be added certain ulcerations and perforations depending on distal stenoses. 2. Typhlitis, simple in character, either "stercoral" or of unknown origin. Class two alone engages our attention.

The acknowledged and well established fact that the appendix is at fault in the overwhelming majority of cases of inflammation in the right iliac fossa must be accepted. Einhorn in 18,000 post mortems found that perityphlitis is of appendiceal origin in 91 per cent. of the cases and that in the remaining 9 per cent. it is due to primary perforation of the cæcum. Surgical experience, according to Treves, would lead us to place the appendiceal cases at a higher percentage of frequency. My object in this communication is to emphasize the fact that a primary typhlitis may be present and should be recognized and treated as such.

Granted that a primary, stercoral typhlitis exists, we may picture its pathology to be somewhat as follows: As a result of the coprostasis, there occurs from both mechanical and chemical irritation, an inflammation of the mucous membrane of the cæcum which may be mild in character (acute or chronic catarrh), soon subsiding, or which may be severe, being induced by stretching of the cæcal wall, causing an anæmia at the point of greatest pressure, to which may be added an abrasion of the mucous membrane, through which infection enters, resulting in venous thrombosis, capillary hæmorrhages, etc. The consequent ulcerations may remain superficial, limited to the mucous membrane, or extend deeper, the necrosis involving all the layers of the cæcum, leading to perforations, which, if slow, in evolution may be shut off by adhesions, and produce local abscesses, or, if rapid in progress, may rupture into the general peritoneal cavity, setting up a general septic peritonitis. Even without perforation of the cæcum, perityphlitic abscesses may arise, just as peri-appendicular abscesses may occur without perforation of the appendix.

It would appear as though the cæcum presented certain anatomical peculiarities which might lead to pathological con-

ditions. It is somewhat of a reservoir of large dimensions and considerable capacity, with the weakest walls of all the large intestines. In addition to which it occupies a dependent position. The most virulent germs of the entire intestinal tract frequent the lowest ileum and cæcum. Foreign bodies as well as undigested masses of food are projected into the cæcum with considerable force, leading to lesions of the mucous membrane, through which infection may enter its walls. Further the fæcal matter first becomes acid in the cæcum, having remained alkaline throughout the small intestine. This is a suggestive fact when one considers the relative frequency of gastric and duodenal ulcers in association with hyperacidity. In a few rare cases, masses of parasites (Schiller, *Beiträge zur klin. Chir.*, vol. xxxiv, 1902; also Blanchard, *Revue de Chir.*, 1906, viii, p. 306) have produced typhlitis and perityphlitis. In many of the cases it seems impossible to explain the etiology satisfactorily. Ulceration of the cæcum probably never occurs simply as the result of fæcal stasis in the cæcum.

Without the aid of the microscope, even with the abdomen open, at times it may be impossible to make a diagnosis of simple typhlitis from tuberculosis, actinomycosis, etc.

Many authorities claim that appendicitis is often secondary to inflammation of the cæcum and colon. If such be the case, then it certainly is not irrational to argue that there may be cases in which the inflammation remains limited to the cæcum, and does not extend to the appendix, in which case we have a typhlitis or cæcitis, pure and simple.

In primary typhlitis the inflammation proceeds from the cæcal mucosa outwards, while ordinarily, in typhlitis dependent on appendicitis, the inflammation progresses first from the cæcal peritoneum through its walls to the mucosa, the infection having emigrated through the walls of the appendix to the peritoneum first.

SYMPTOMS.

An extended description of the symptoms of primary typhlitis without any appendicitis being present is unnecessary. Whether acute or chronic, we must admit that they are similar

to and usually indistinguishable from appendicitis. Many give a history of obstinate constipation, others have diarrhœas, leading one to suspect an antecedent colitis. Many have repeated attacks, either severe or mild, and these may be explained as due either to disturbances in the healing of an ulcer, or to renewed fæcal impaction, with the formation of new ulcers, infection and inflammation of the cæcum and its neighborhood. Perforation and peritonitis may be an early symptom, or perityphlitic abscesses may occur. True appendicitis may be a secondary complication. It will often be impossible to ascertain which is primary, the cæcitis or the appendicitis.

TREATMENT.

In view of the impossibility of diagnosing whether the disease is confined to the cæcum alone or involves also the appendix, laparotomy is the proper procedure, dealing with the conditions as they present themselves. A perityphlitic abscess will require to be opened and drained, removing the appendix, if it be accessible, as it may prevent future complications. A perforation of the cæcum should be closed, if it can be exposed without breaking up surrounding adhesions. Gangrenous areas surrounding perforations of the cæcum should be excised, taking care to cut well out into sound tissue. Ulcerated patches, which threaten to break through the wall of the cæcum, should be infolded with one or two layers of sutures. General peritonitis will require closure of a perforation, possibly lavage of the general cavity, drainage of the pelvis and, later, the exaggerated Fowler position. Intestinal obstruction may require resection of the ileocæcal region. In some rare cases it may be impossible to tell whether we are dealing with a simple typhlitis or a cæcum affected with cancer, tuberculosis or actinomycosis. In such a case it would be well to remove a piece of the cæcal wall for microscopical examination, closing in the defect with appropriate sutures. According to the microscopical findings, it may later be determined whether a secondary operation, such as resection, will be required. At the time of the primary

operation, there may be such a degree of perityphlitis present that it would be better judgment to defer a resection of the intestine until such time as the infection of the peritoneum had subsided, which thorough drainage would favor.

As a further contribution to the subject, I wish to report the following case.

A man, forty-eight years of age, was admitted to the Medical Division of the Presbyterian Hospital on August 16, 1906. He had worked up to two weeks prior to his admission, at which time he vomited for three days almost everything that he ate. There was no blood in the vomitus nor in the stools, which were very constipated. This was followed by general malaise, loss of appetite and a sense of gastric oppression after eating. Lost fifteen pounds in past month. Had had no acute pain, fever, pulmonary nor urinary symptoms. A few years prior to his admission he had been laid up for several years with a weak back, following an injury, and he had had during this time an abscess opened over his ribs. There was present a well-marked dorsal kyphosis. Abdominal examination was negative, there being no rigidity nor any masses present nor tenderness. After one week he was discharged with the diagnosis of chronic gastritis. The man was readmitted, one month after his discharge, on September 21, 1906. After leaving the hospital, four weeks prior, he was well for one week, at which time he began again to vomit, this being brought on by the taking of food. The vomitus consisted of food and mucus, but no blood. Had severe pains in the right hypochondrium, right epigastrium and right iliac regions. Pain and vomiting have both been more or less continuous. Has had diarrhoea with mucus, alternating with constipation. There has been fever, with chills and sweating, and he has been much prostrated.

Examination on Admission.—Patient looks sick and prostrated. Temperature 102.6°, pulse 110. Leucocytes 16,600. Exquisite local tenderness and rigidity in the right iliac fossa, where there was felt the sense of a mass, somewhat rounded and slightly movable, about the size of a lemon. There was tenderness to the right on rectal examination.

It seemed to be a clear case of an acute appendicitis, with probably an encapsulated abscess. It was considered to be such

by the attendant physician. It was also deemed probable that this had followed a colitis. The patient was transferred to the Surgical Division, and was operated upon at 11 P.M., the day of his admission. Kammerer incision over the mass, which was found to be the much enlarged cæcum, free from adhesions and most intensely congested. Its peritoneal surface was dull and rough and its walls were irregularly thick and hard. In places it felt fully half an inch thick. No faecal masses could be palpated in its interior. There was some serous fluid about the cæcum and in the pelvis, of which a culture was taken (later reported to be staphylococci). The appendix was found retrocæcal, free from adhesions, only an inch and a half long. Its peritoneal coat looked normal, glistening and not inflamed. It was removed and cut open by a bystander. Its mucous membrane looked fairly normal, possibly a little congested. It was evident at once that the appendix was not the cause of the trouble. Further examination revealed a normal ascending colon above the cæcum, and the small intestine looked perfectly healthy in every way. There were no adhesions anywhere. On account of the great thickness of the cæcum, it was deemed to be affected with either localized tuberculosis (particularly as he had an old kyphosis) or cancer, upon which an acute inflammation had been grafted. Resection seemed to be the proper procedure. The small intestine was divided, two inches from the ileocæcal junction, between clamps and the end closed. The colon was divided just proximal to the hepatic flexure between clamps and its end likewise closed. Anastomosis with silk was made between the side of the small intestine and the side of the transverse colon. Cigarette drainage of the right iliac fossa. At the conclusion of the operation, which lasted a trifle over an hour, the patient was in good condition, requiring no stimulation at the time. He died, however, the next afternoon of acute dilatation of the heart, responding in no way to all kinds of stimulation.

Pathological examination by Dr. Berkeley. The gross appearance looks like tumor of the cæcum. Microscopical examination shows simple inflammation. Culture from fluid near the cæcum gives staphylococcus pyogenes aureus. Specimen consists of a mass 4 x 3 x 2 inches, containing cæcum and adjacent gut, stump of appendix, some mesenteric and peritoneal tissues. Wall of cæcum is thickened (one-half inch thick) and papillated in

places, suggesting infiltration with growth or inflammatory tissue. There are three or four ulcerations, admitting tip of finger, on the surface of the mucous membrane of the cæcum, and these are covered with a grayish slough. Microscopical examination shows intense, acute, suppurative inflammation of the intestinal wall, necrosis in places and very general œdema. The process seems to have affected more or less all the intestinal layers at and adjacent to the cæcum. Lymph gland contains a stony, calcareous mass, one-quarter of an inch long. The gland is partly broken down under the microscope. No tuberculous structure made out. The appendix shows acute inflammation. Without question the inflammation proceeded from within the cæcum and was not communicated to it from its peritoneal surface, as ordinarily occurs in an appendicitis.

The case is instructive from many standpoints, both as to the etiology and diagnosis and treatment of the condition. It seems to me that one is forced to the conclusion that it was an instance of primary, acute, suppurative inflammation of the cæcum. While the appendix was inflamed, this could not for a moment be thought to have caused the typhlitis or the perityphlitis, for the inflammation of the appendix was mild in comparison with the intense, suppurative, necrotic inflammation of the cæcum itself. This latter had simply begun to spread secondarily to the appendix, which process was to have been expected. It is probable that the appendicitis would have become severe and dangerous at a later date. It is difficult to explain the origin of the cæcitis. He had had an antecedent constipation, which probably set up an inflammation of the mucous membrane with an abrasion to which was added an infection and ulceration which produced a perityphlitis without any perforation of the cæcum. The case illustrates also how difficult it may be to make a diagnosis, even with the abdomen open, of the pathological condition of the cæcum. This latter fact was further exemplified in a recent experience where a perityphlitic abscess, supposed to be of appendiceal origin, was opened, the appendix not being seen. In a second operation for continued suppuration, a

section of the somewhat thickened cæcum showed under the microscope carcinoma.

CONCLUSIONS.

From the evidence brought forth above, the following conclusions seem amply justified:

1. Primary, acute and chronic typhlitis occurs independently of appendicitis, dysentery, tuberculosis, actinomycosis or cancer, and is idiopathic in origin or depends on coprostatitis.

2. Primary typhlitis, the appendix being normal, may lead to perforation, with the formation of perityphlitic abscess or general peritonitis.

3. The symptoms of primary typhlitis are usually identical with those of appendicitis and the indications for operation are similar in the two conditions.

4. Primary typhlitis is rare in comparison with the frequency of appendicitis.

5. The differential diagnosis of inflammatory typhlitis from tuberculosis, cancer and actinomycosis may be impossible at operation, in which case a section of the cæcum should be removed for microscopical examination.

6. The recurrence of symptoms after removal of the appendix may be due to attacks of typhlitis, the treatment for which consists in the regulation of the diet and the use of oil enemata, etc.

7. The danger of a primary typhlitis consists in the liability to the rupture of an ulcer and to the development of appendicitis.

8. Purgatives are contraindicated in inflammations of the right iliac fossa because of the danger of rupturing an ulcer in the cæcum or appendix, or of breaking up the adhesions about an abscess.

9. The treatment of primary typhlitis consists in laparotomy, removal of the appendix, closure of any perforation if possible, invagination of any threatening perforation of the cæcum, drainage of the right iliac fossa and the removal of a piece of the cæcal wall for microscopical examination, if that be necessary to establish the diagnosis.

THE ADEQUACY OF LOCAL ANÆSTHESIA IN INGUINAL HERNIA OPERATIONS.*

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MODERN surgery advises a patient with inguinal hernia to submit to operation for cure, and in lieu of this curative advice the patient accepts his hernia and a truss. Two or three million of ruptures in the United States rejecting this surgical advice constitutes a defeat for modern surgery in its application to the people. The surgical proposition of 90 per cent. cure, short detention from business and a small danger to life, would seem attractive for the relief of a deformity to person, 15 to 50 per cent. loss of earning capacity and a potential death, yet the number of trusses worn attests the colossal rejection of this proposition. Further curtailment of the hospital detention is impossible, new methods of closing the canal to increase permanent cures improbable, and the small danger to life is stationary in the anæsthetic. To this last particular surgery must look for improvement in the attractiveness of its proposition. General narcosis, with its small but certain danger to life and its disagreeable features presents a deterrent factor to accepting a surgical operation for the cure of hernia. If, then, we eliminate the danger, the dread and disagreeableness of general narcosis, we may turn a conspicuous surgical defeat into a colossal victory.

The absorption of cocaine into the substance of the spinal cord produces analgesia of the body below the level of the point of introduction and likewise the introduction of cocaine into the substance of any spinal nerve produces analgesia throughout the area of its distribution. Some failures to produce analgesia occur after introduction of cocaine into the spinal canal, but its

* Read before the Surgical Section of the New York Academy of Medicine, March 1, 1907.

analgesic effects invariably follow its introduction under touch and eyesight into the substance of a nerve trunk. The nerves supplying sensation to the entire area involved in the operation for cure of inguinal hernia are the ilio-inguinal, iliohypogastric and genitocrural. The peritoneal prolongation or sac is, of course, differently supplied.

In earlier operations effort was made to cocainize all three nerves mentioned, but it is unnecessary. Cocainization of the ilio-inguinal nerve alone with infiltration into certain well known sensitive areas suffices for a painless dissection. Finding and identifying this nerve is an easy matter in almost every case. In the rarest of instances has it failed to appear immediately upon reflecting the external oblique aponeurosis. In these instances the nerve had broken up into its distributing branches prior to its entrance upon the field of operation. The two other nerves, if seen during the operation, are cocainized, but no search is made. The areas supplied by them are few and well known and easily made analgesic by infiltration. The technic has been fully explained in a previous paper and will not be repeated here. If the skin and subcutaneous tissue are properly infiltrated by a 1 to 500 warm cocaine solution the incision down to and through the external oblique aponeurosis is totally devoid of pain to the patient. As a matter of fact, they frequently do not know the difference between the cocaine infiltration and the incision. It is to be remembered in explanation of the clinical report which follows, that but few blood vessels and nerve filaments are encountered in the incision to and through the external oblique, if said incision is not yet carried to or below the level of the external ring. At this latter point the ilio-inguinal nerve expands into many filaments and the bleeding points are numerous. It is, therefore, essential to find and cocainize the ilio-inguinal trunk before incision into this level. After finding and cocainizing the ilio-inguinal at the upper limit of the hernia incision, the operation in simple cases can be completed without additional analgesia and with little or no complaint of pain. Infiltration is necessary into the internal oblique around the arching fibres of the internal ring

and around the sac neck during its dissection within the margin of this opening. *It is solely upon anatomical grounds that the operation for inguinal hernia lends itself peculiarly to local anæsthesia.* The facility with which the sensory nerve supply is found and obtunded, the restricted and superficial area of operation, paucity of blood vessels, simple character of visceral handling and, above all, the likeness of one operation to another, step by step, so that the technic can be systematized. The simplest case of rectal surgery, be it hæmorrhoids, fistula or fissure, does not from anatomical or clinical reasons so justify local anæsthesia in its performance. In fact, the adequacy of local anæsthesia in hernia operations does not obtain either theoretically or clinically in the same satisfactory measure in any other operation in general surgery. Few surgeons would subject an adult patient to general narcosis for a circumcision, yet in my own experience (to eliminate the question of personal equation) a hernia is as satisfactory as a circumcision.

Suppose we study the adequacy of local anæsthesia in detail.

Pain to Patient.—As an objective index to pain, the patient is made to assume an attitude of relaxation, feet together, his fingers locked over his chest. The sudden movement of either hand or foot would be regarded as evidence of acute pain. A number of changes in this position would indicate a moderate pain continued to a point of restlessness. Not a single patient has as yet produced this evidence of either acute or moderate pain. None have grumbled or complained during the operation, while in the majority every objective evidence of pain has been absent, even in facial expression. As negative and subjective evidence of this point, in double herniæ, the patients were willing and often desirous of having the second side operated upon at one sitting; some have had the second side operated upon one, two or more days following the first, and none have expressed either dread or unwillingness for the second ordeal. To each and every one of the double cases general narcosis was offered as a test at the second operation and refused. I am satisfied that the pain is so little it can be

called painless, when compared with the nausea following ether. Where adhesions exist to the parietal peritoneum within the internal ring, pain was expressed during the separation, but so far has not been sufficient to discourage the patient or embarrass the operator. The most practical evidence on the quality and quantity of pain is the increasing number of patients seeking operation at the clinic sent by one another.

Thoroughness.—An operation, if curtailed in respect to thoroughness, would discredit the adequacy of the analgesic. As the patient is flaccid, quiet and uncomplaining, no temptation to shorten or curtail the operation is presented to the operator. Every modification of the simple Bassini has been practised, varicoceles, lipomata and cysts have been met, transference of the rectus muscle, deviation of the sac neck and placing an undescended testicle have been practised. Amputation of omentum in any quantity is shocky, but not painful.

Safety to Patients.—Safety to patient is the guiding rule for all surgeons. With a hernia the patient weighs well this feature. His familiarity with the lesion on account of frequency amongst his acquaintances invites him to consider chances of death, pain, expense and detention from business more than, for instance, interval appendicitis. That a solution of cocaine, amounting in sum total to any fractional part of a grain intermittently injected during an hour of time is less dangerous than cerebral narcosis for the same period is obvious and that it is entirely without danger to the patient is probably a fact. The subject of a hernia readily accepts this point.

There is at times a set of symptoms once regarded as toxic manifestations of cocaine, sweating, pallor and sighing. They are purely psychic and in no way toxic. The strangeness of being cut, even without pain, is responsible, and as surgery under local analgesia becomes better known to the people, these psychic phenomena will become less frequent.

Limitations.—Fat presents the principal limitation to the method. It is impossible to œdematize, and there is pain during the incision through the layer of fat; but the principal difficulty is in the necessary retraction for exposure in a wound so deep.

This limitation, however, is inoperative if the least contra-indication to general anæsthesia exists. The fat subject can be operated upon under local anæsthesia successfully, but not painlessly. Age, atheroma, lesions of kidney and heart offer no barrier. These belong to the class where general anæsthesia is contra-indicated and but emphasize the utility of this method. Very large complicated herniæ are limitations in a relative sense only, because the handling of gut and omentum causes no pain if their attachments are not dragged upon. Popularization of the method would be conducive to operation while the hernia was small. This would be a great advantage. "The smaller the hernia, the more certain the cure," is a truism. This method of analgesia does not figure in the hernia of early childhood. Boys of ten years of age have twice been successfully operated upon. In strangulated hernia local analgesia rises almost to the dignity of an imperative method. The added shock of an hour under cerebral narcosis—danger from drowning in fæcal vomit and the hurried decision as to whether the loop of gut should be excised or not, accentuate the advantage of a method that does not shock, permits the patient to control the vomit and gives any quantity of time to decide on the circulation in the gut.

In one instance the gut was wrapped in hot saline cloths for over an hour, until the circulation was established beyond a doubt. Even resection of the gut is not impossible in strangulated hernia, because the loop is already out of the cavity and permits excision and suturing without dragging on the mesentery.

There is little or no pain in the division and suturing. If unconsciousness is thought best at this stage, cerebral narcosis can be temporarily added.

A case in point is Michael Keegan, October 19, 1906, Polyclinic Hospital, with strangulated hernia. The imprisoned loop was gangrenous and perforated. In fear of suffocation from the fæcal vomit, it was decided to attempt the excision under local analgesia. Clamps were applied to the bowel and 12 inches of ileum excised, the ends sutured without additional

cocaine. The patient was mentally alert and acutely perceptive. The possibility of excision of the bowel obtains only in strangulated hernia and not when any manipulation *within* the peritoneal cavity is needed.

Meltzer, of this city, has lately made a statement on experimental evidence that the introduction of cocaine into the circulation at any point in the body reduces sensation in the gut. Possibly here is the explanation. Certain advantages are inherently associated with local analgesia. It imposes upon the surgeon respect for tissues, gentleness of manipulation amounting to daintiness.

Blunt dissection, tearing or rubbing the sac from the cord with gauze pads is impossible. The number of times the wound is swabbed is economized and all this is as it should be for the welfare of the wound. Clean-cut dissection is necessary from beginning to end. The signal advantage of this method is the preservation of the structural integrity of the nerves in this area. They are sought, not only to be cocainized, but to be preserved from injury. Division or other injury to these nerves has probably been the rule rather than the exception during operations for hernia. No text-book or monograph on this subject bespeak them respect or preservation. Thinning, atrophy and paralysis follow division of a nerve trunk as an inexorable law, and must, to a greater or less extent, follow injury to the ilio-inguinal or hypogastric nerves. The structures supplied are the very ones relied upon to close the canal and make permanent the cure. Thinning or atrophy must invite recurrence. So important does this appear that it seems strange emphasis has not been laid upon it heretofore.

Nausea and vomiting following ether may or may not jeopardize the integrity of the deep stitches, but its absence under local analgesia is both grateful to the patient and a safety to the wound. If the application of this method were peculiarly within the ability and skill of a few operators and not the common property of all surgeons, it would be of little or no value to surgery.

Each member in the clinic, each and every succeeding

house surgeon in the hospital for the past three or four years, together with numerous students throughout the country, have adopted the method and perform the operation with entire satisfaction to themselves and to the patient.

Recurrences.—The recurrences have not been computed, but it would seem a reasonable hope that preservation of the nerves innervating the structures upon which permanency of cure depends would prove a practical as well as a theoretical conclusion. This much can be said, the percentage of recurrences of one operator under local analgesia will be that same operator's percentage of recurrences under cerebral narcosis.

A personal experience of over four hundred operations for radical cure of inguinal hernia with local cocain analgesia forms the basis of the foregoing remarks. Since the first operation of this series, no case of inguinal hernia has been operated upon under any other kind or method of analgesia.

Consequently, the experience embraces nearly all variations of the simple hernial protrusion and nearly, if not all, the different types of patients.

It is the conclusion of this paper that local analgesia is entirely adequate for the radical cure of inguinal hernia.

CYSTS OF THE SUPRARENAL GLAND.

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THE classification of tumors of the suprarenal glands is far from perfect. Numerous isolated cases of different varieties of tumors have been reported, but until within recent years their classification has been very unsatisfactory. We know that tubercular processes of one or both of these organs are not uncommon. Probably about 80 per cent. of the lesions of the adrenal body are of this character. A few successful operations for removal of a unilateral tubercular adrenal have been reported.

It is not my intention in this article to discuss the various types of tumors or that interesting class of cases, the aberrant adrenals. I will but briefly mention the different growths which have been described as developing in these bodies.

Malignant Tumors.—Numerous cases have been reported. The classification of several of these tumors has, however, been very indefinite, and it has been uncertain whether the term carcinoma, sarcoma, endothelioma or adenoma should be applied. It can, I think, be positively stated that primary carcinoma is very rare, primary sarcoma perhaps slightly less rare. Ramsay¹ has collected 37 cases of primary carcinoma and 30 cases of primary sarcoma of the adrenal bodies. On the other hand, secondary involvement with either of these malignant growths is quite common.

Adenoma.—A number of cases have been reported where a tumor or tumors of this character have been found at autopsy, and a few doubtful cases have been found at operation. Such tumors occur either as numerous small nodules situated in the cortex, or as masses of considerable size which develop in the substance of the gland. The appearance of these growths does not differ much from that of the normal cortex. Occasionally,

as the result of degeneration, small cysts are found in these tumors. Virchow used the term *struma lipomatosa suprarenalis* to certain growths, probably adenomata, which had undergone fatty degeneration.

FIBROMA. GLIOMA. ANGIOMA. LYMPHANGIOMA.

Cysts.—The classification of adrenal cysts rests upon rather an indefinite basis. Those of a malignant, parasitic or tubercular character should be easily recognized, though it is true that in the past there has been considerable confusion in the nomenclature of even the malignant types. There remain, however, certain cysts which can not be classed under either of these three divisions. True cystomata are unquestionably very rare. Sick² reports a case of ciliated epithelial cyst found at the autopsy of a female who succumbed after a hysterectomy for uterine cancer. In his discussion of the case, he enters fully into the nature and origin of adrenal cysts. There still remains, however, a considerable number of cysts which will not properly arrange themselves under any one of these divisions. There has been considerable discussion in regard to their origin and true character. Such terms as angiomatous, lymphangiomatous, lymphangiectatic, lymphatic, follicular, strumous, degenerative, retention, infarction, etc., have been applied, and it is very difficult to classify many of the cases under any special head. Some are undoubtedly due to the cystic degeneration of angiomatous or lymphatic tumors, others to the degenerative process resembling that which occurs in the aberrant adrenals of the kidney. Klebs considers them as analogous to the multiple retention cysts of the glandular organs, inasmuch as they arise from the glandular tubes of the adrenal cortex. Virchow³ and others describe these cysts as analogous to those which as a result of a cystic follicular inflammation, develop in the thyroid gland, the so-called "suprarenal struma." Henschen,⁴ in an elaborate article on this subject, is inclined to share this view, and claims that many adrenal cysts are similar to those which form in goitre, and he still clings to the old term "struma adrenalis." Drou-

blaix⁵ and Fielder⁶ also incline to the same belief, that many of these cysts take their origin from a parenchymatous degeneration of the gland, a form of acute inflammation. The hæmorrhagic origin of these cysts is emphasized by many writers. Apparently, in certain cases a hæmatoma has been the exciting cause of the cyst. By some writers this is considered the most common cause. A hæmorrhage, however, which has occurred in a cyst already existing, may so alter the characteristics of that cyst, that its original character is not recognizable. In this connection, hæmorrhage due to thrombosis of the adrenal vein, either its main trunk, or one of its chief branches, must be considered. Simmonds⁷ collected 7 such cases, but these all occurred in patients with some form of chronic disease of the heart or lungs. It is a question whether such thromboses are not produced by some pre-existing disease of the adrenal body.

The relationship of hæmorrhage to adrenal cysts is certainly of interest. Adrenal hæmatoma in the newborn is not uncommon. We are at a loss, however, to explain the reason for such hæmorrhages. Can the compression of the infant's abdomen during its passage into the world be the cause? Is it possible that, at the moment of change from the foetal circulation, there is some unknown activity of the adrenal gland? On this point we must confess ignorance. We know that in the foetus the suprarenal body is proportionately large and very active. As to the frequency of hæmorrhages in the newborn, authorities differ. Thus, Mattei⁸ found that in 100 autopsies, 75 of the cadavers showed some sign of hæmorrhage. Rolleston⁹ in 130 autopsies found similar indications in 26. Adrenal hæmorrhage in the newborn is probably not uncommon, but in the great majority of cases there are no symptoms to indicate the occurrence of such a lesion, and the hæmatoma is quickly absorbed. It is equally difficult to understand why in adults these hæmorrhages should occur. The deep situation of the adrenal bodies would seem to be sufficient protection from injury, except that of the severest character, and yet in a certain proportion of these cases the cause has

apparently been a trauma. These organs are exceedingly vascular, and at times are subject to temporary passive engorgement. Another cause of hæmorrhage is unquestionably bacterial invasion, and several hæmorrhages of considerable size have been reported as due to this cause. The hæmorrhage may be also due to toxæmia from irritating chemical poisons. In animals who have been injected for experimental purposes with sera or antitoxins, as, for example, that of diphtheria, severe congestions and occasionally hæmorrhages have occurred. The hæmatoma are usually of small size, varying from that of a pea to a hen's egg. They are often laminated, the layers of different shades showing the repeated hæmorrhages, and the different stages of organization of the clot. Large hæmorrhages are rare. The hæmorrhage generally occurs, either in the deepest part of the cortex, or in the vascular zone between the medulla and the cortex. If the hæmorrhage is considerable in amount, the capsule may be ruptured. Arnaud¹⁰ found that this accident had occurred in 6 out of the 79 cases of adrenal hæmatomata which he had been able to collect. In a few cases there has been very extensive blood extravasation and even rupture through the peritoneum into the abdominal cavity. Undoubtedly the majority of these hæmorrhages are absorbed and leave no trace.

In other cases, however, some structural change remains. If the hæmorrhage has been great, there may remain an encapsulated adrenal hæmatoma. In the encapsulating connective tissue, as well as in the semi-organized clot, there may be found chalky deposits and small cysts. Orth¹¹ says that a cystoid transformation may occur, fluid taking the place of the blood-clot. It is difficult to estimate the comparative frequency of these hæmatomata. The great number will probably give no symptom which would call attention to the suprarenal bodies. Mattei, in his examinations of 1301 cadavers, found that in 7 there were changes which indicated that at some previous time an adrenal hæmorrhage had occurred. Leconte¹² collected 52 cases of adrenal hæmorrhage in adults. Of these 33 were double, 8 right sided and 11 left sided.

Arnaud¹³ reports 4 cases of very large adrenal hæmatomas. The causes were: 1. Burns. 2. Hydatid suppurating cyst of liver. 3. Abscess of the liver. 4. Cerebral apoplexy. In 69 cases collected by the same author, there were in 40 various pathological conditions of the adrenal bodies, which would account in part for the hæmorrhage.

Some of the causes which are assigned for adrenal hæmatoma are: Hæmorrhagic diathesis; co-existence of renal disease; chronic diseases of the circulatory and respiratory organs; septicæmic infections; acute toxic diseases, such as diphtheria, typhoid, osteomyelitis, etc.; tuberculosis; abscess of liver; burns; atheromatous arteries; cerebral lesions, apoplexy and meningitis; thrombosis of renal or adrenal vein.

The following brief reports of large adrenal hæmorrhage may be of interest.

CASE OF J. GREISELIUS (quoted by Rayer, *Journal d'Experience*, 1873). Male, æt. forty-five. Tumor in the left hypogastrium, which had ruptured intra-abdominally. Autopsy showed 12 pounds of blood in the peritoneal cavity.

CASE OF RAYER. Female, æt. seventy-five. For five years had suffered from crises of pain with vomiting and accompanied by bloody urine. Two months previous to death a cystic tumor was felt in the left hypogastric region. At autopsy 3 pounds of blood was found in the left adrenal body.

CASE OF CHIARI. Male, æt. sixty. (*Wien med. Presse*, 1880.) At autopsy a large mass of blood the size of an adult head, partly ancient, partly recent, was found in the right adrenal body.

Parasitic Cysts.—A few cases of echinococcus cysts, both uni- and multilocular, have been reported. For example, Huber¹⁴ reported a small multilocular echinococcus cyst found at the autopsy of a man aged sixty-two. Perrin¹⁵ reports a unilocular cyst of the right adrenal found at autopsy.

Numerous cases of adrenal cysts in animals have been reported, such as 2 cases of colloid cysts in the horse, reported by Bruckmüller and Kitt ("Lehrbuch Diagnostik Thierärzte," 1895). 1 case of colloid cyst in a horse, reported by Manasse ("Virchow Archiv," vol. cxlv.) Several cases of epithelial cysts in birds reported by Kelly, Joubert and others.

Cases of cysts of large size have been reported by Rayer,¹⁶

Bossard,¹⁶ Chiari,¹⁶ Obendorfer,¹⁷ Marchetti,¹⁸ Krogus,¹⁹ Schilling,²⁰ Lockwood.²¹ The cases of Risdon-Bennet,²² Klebs,²³ Morris²⁴ and Leconte²⁵ are of doubtful character.

As already stated, the pathological classification of these cysts is rather unsatisfactory. One of the best is perhaps that of Henschen:

1. Foreign body cysts (parasitical cysts).
Echinococcus unilocularis et multilocularis.
2. True cysts (cystomata).
 - a. Epithelial cysts.
Follicular cysts.
Ciliated epithelial cysts.
 - b. Endothelial cysts.
Lymphangiectasies.
Lymphangiomata.
3. False cysts (cystoids).
 - a. Tuberculous pseudocysts.
 - b. Disintegration (softening) cysts.
 - c. Hæmorrhagic cysts, originating by hæmorrhagic disintegration, or secondary metamorphosis of primary true cysts.

The following operations for removal of large adrenal cysts have been collected from the literature of the subject. The internal surfaces of the cyst walls have been quite characteristic, in all these cases small orange or yellowish-brown colored patches being dotted over the surface. These patches have varied in size from a minute speck to a plaque 1 cm. or more in diameter. The fluid has also been of a grayish-yellow or orange-brownish hue.

1. CASE OF KRONLEIN (rep. by Henschen).—Female, æt. forty-one. No history of trauma. During twenty years various diseases—pleurisy, epigastric pains occurring in attacks with vomiting, puerperal phlebitis, etc. In January, 1905, attack of rheumatism in several joints. A month later a swelling found in left loin, the diagnosis being, "hæmorrhagic cyst of the spleen which had ruptured into the left pleural cavity." Large cystic tumor under left costal arch. Puncture of cyst, 100 cm. of fluid extracted,

thin chocolate-colored, brownish in color, with cholesterin on surface and containing numerous fatty masses. Operation (laparotomy, February, 1905). Cyst extirpated, wall 3 to 8 mm. in thickness, its interior chocolate-colored, speckled with yellowish islands looking like sulphur or yellow butter. Followed by severe collapse. Death on fifth day, apparently from sepsis.

2. CASE OF ROUTIER (*Bull. Soc. Anat. de Paris*, 1895).—Female, æt. thirty-six. No history of trauma. Ill for three years. Attacks of severe pain occurring in crises, rather intermittent. Operation (median laparotomy, December, 1894. Cyst contained 3 litres brownish fluid, could not be removed. Marsupialized. Death on third day due to peritonitis.

3. CASE OF PAWLICK (*Arch. klin. Chir.*, vol. liii. p. 582).—Female, æt. forty. Had been ill for five years. Large fluctuating tumor in left loin. Diagnosis uncertain as to pancreas, kidney or suprarenal body. Operation March 1, 1894. Through a canula 10 litres of bloody fluid ran out. Enucleation of greater part of the cyst wall, as far as the vertebral bodies; small portion left behind, cavity drained. Severe collapse followed the operation, with very slow convalescence. Two years later the patient was in good health.

4. CASE OF BIER (quoted by Henschen).—Female, æt. sixty-nine. Cystic tumor in right hypochondrium. Cyst contained 2 litres dark brown fluid, mixed with coagula, and could not be removed. Marsupialized. Death from shock at the end of a few days.

AUTHOR'S CASE.—A. H., female, æt. 45, married. Family history negative as to cancer or tuberculosis. Personal history good. Use of alcohol denied. Amputation of cervix uteri had been performed in October, 1905. About three years prior to admission to the hospital patient began to notice dull indefinite pain in the left loin and lower abdomen. The pain radiated downward towards the left hip and thigh. There were occasional sharp exacerbations of severe lancinating pain. The pain increased and soon became so severe that the patient resorted to the use of morphine, which she had employed in increasing doses for about two years. In less than a year after development of pain the patient noticed that the left side of her abdomen was becoming more prominent than the right, and soon afterwards she appreciated that a mass in her left hypochondriac region was steadily increasing in size, becoming more prominent and more tender. Her general health, up to the past six months had been good, but latterly she had begun to fail rapidly, and in the past few months had lost over 20 pounds in weight. She also noted that urination became more frequent, noted slight bronzing of the skin. On examination there was marked bulging in the left hypochondriac

region. A cystic tumor was felt bulging out the lower ribs, and extending well up under their free border, towards the vault of the diaphragm. The tumor was smooth and elastic to the touch, and gave a distinct sense of fluctuation very much as would a rather thick walled ovarian cyst. The tumor, however, was quite immovable, except that it moved up and down with respiratory movements. Its lower border extended to within 3 inches of the anterior superior spine. Its inner border was about 3 inches from the mid-abdominal line. It was rather globular in shape and appeared to be about the size of a large adult head. It could not be grasped between the hands as easily as one can generally grasp a renal tumor. Neither did it bulge out as far laterally. The left kidney could not be recognized. The colon was internal to the cyst. The diagnosis was uncertain. It rested between a pancreatic, renal or suprarenal cyst.

Operation, May 24, 1906.—An oblique incision was made parallel in its upper part to the last rib and at its lower part curving forward towards the umbilicus. When the tumor was exposed, it was found to be cystic, the color of its wall rather dullish gray. It was universally adherent, the colon being in front and inward. With a trocar and canula 9 pints of yellowish-green, dirty-looking fluid were removed. It was thin in consistency, but floating in it were numerous small flakes, yellowish-brown in color, and also cholesterine crystals. The kidney was now recognized, pushed down into the patient's pelvis and adherent to the lower pole of the cyst. The latter was separated from it without injury to the kidney. The removal of the cyst was very tedious, on account of the numerous blood vessels which required ligation. The dissection was especially difficult where its wall extended to the median line, at which point it was attached to the vertebral bodies and wall of the aorta. The sac was completely removed; no pedicle was recognized. Three long artery forceps were left *in situ*, as they clamped vessels near to the median line where ligation would have been most difficult. The wound was sutured, a gap being left through which a strip of gauze and a rubber tube were inserted for drainage. The duration of the operation was about 60 minutes. There was but little shock and the patient left the table in excellent condition. The convalescence was uneventful. The patient was out of bed on the eighteenth day, and returned home on the twenty-fourth day.

Since the operation the patient has been free from pain, and as far as the loss of the suprarenal is concerned, enjoys good health. The slight bronzing of the skin disappeared soon after the operation.

Pathological Report by JOHN M. THACHER.—Macroscopical examination: Ruptured cyst. Wall averages $\frac{1}{8}$ inch to $\frac{1}{6}$ inch thick, showing granular red and yellow surface interiorly, and numerous small ($\frac{3}{4}$ inch) roundish nodules of fibrin. Yellow flakes and dots in various layers of wall resemble calcified (?) patches; and larger ones cut with gritty or chalky feel. There is no discoverable pedicle, the outer surface having been apparently adherent everywhere.

Microscopical examination: The cyst wall shows internally fibrin, blood cells, no lining cells. Next comes a generally distributed calcified area lying in coarse strands of c. t. Exterior to this are oval and elongated masses of cells which appear to constitute a cellular neoplasm of the mesoblastic type. The cells are rounded and plump, outlines indistinct, nuclei clear and a little larger than red cells, cytoplasm sometimes coarsely granulated or globulated. The cells are in small groups supported by very fine c. t. strands. The general structure is that of endothelioma, or of the tumors commonly called aberrant adrenals.

Symptoms.—The symptoms of adrenal cysts are at first apt to be rather indefinite, and even after the development and recognition of a distinct tumor exact diagnosis is generally very difficult. The first symptom noticed by the patient is often a vague indefinite ache in the hypogastric region. Instead of an ache, the sensation may be described as a stabbing neuralgic pain, suggesting neuralgia of the lower intercostal nerves, or pleurodynia. The patient is apt to describe the pain as originating from the depths of the hypogastric region, well up under the vault of the diaphragm, from which area it radiates outward in the direction of the loin or perhaps around the abdomen.

Instead of a gradual development of symptoms, however, the onset may be severe and sudden, somewhat resembling that of acute pancreatitis. The cause of this stormy onset is probably a hæmorrhage in the suprarenal body, with resulting hæmatoma, which affords a starting point for the development of a cyst. The nausea, vomiting, severe pain and perhaps collapse, which accompanies such an onset, may be again

repeated during the farther development of the cyst, and the cause is probably another hæmorrhage within the cyst wall.

Other symptoms, as a rule, do not develop until the tumor has attained considerable size. A feeling of pressure and a sense of enlargement of the upper abdomen may be the first symptom which demands painstaking examination and reveals the presence of a tumor. The growth of the tumor in some cases has been quite rapid, in others very slow. Generally, however, more or less indefinite symptoms have persisted for many months before the presence of a tumor has been appreciated. As the tumor increases in size, the pressure symptoms become more pronounced. The pain is apt to increase after the meals, when the stomach is distended. Vomiting will often afford relief. In certain cases the pain may come in paroxysms with vomiting. There is often a sense of constriction of the lower chest and some difficulty in breathing. These thoracic manifestations are probably due to the tugging of the tumor on the fascia præ- and retro-renal (Testut) which connects the suprarenal body with the diaphragm.

The patient may be the first to call attention to the bulging which he notices under the free border of the ribs, or the surgeon may, in examination for the deep-seated pain, be the first to discover the mass, which gradually enlarges downwards and forwards. Generally, however, the outline of the cyst cannot be definitely defined until it has attained considerable size. It then feels like a more or less globular, smooth, elastic and rather tense tumor. The wave of fluctuation is apt to be indistinct. The sensation from palpation resembles that of a fairly thick walled unilocular ovarian cyst. The projection of the tumor is apt to be upwards towards the vault of the diaphragm, rather than outwards toward the loin. It gives an impression of immobility. This is due to the firm attachment of the suprarenal bodies to the back. At first it is apt to move with respiration. Its projection upwards against the diaphragm may displace the heart and compress the lung, causing circulatory and respiratory disturbances. The kidney is usually dislocated downwards, the pancreas downwards and

forwards, the liver upwards and forwards and toward the median line. The colon of course rests in front of the tumor. It is generally pushed over towards the median line.

As already stated, the exact recognition of an adrenal cyst is very difficult. Its differentiation from renal, pararenal, pancreatic and splenic cysts is often impossible. Adrenal cysts are apt to feel more firmly fastened to the back than are pancreatic cysts, which often are to a certain extent movable. Renal cysts are inclined to grow more towards the lateral wall of the loin; they can also be more easily palpated by bimanual examination, and appear less fixed. Their shape is also apt to be more or less oval rather than globular. The urinary examination is of but little value, as in either case abnormal constituents may be either absent or present. The kidney is often dislocated downwards by these cysts, and it sometimes can be recognized well down towards the pelvis. Unfortunately, however, for differential diagnosis, it is generally adherent to the cyst, which fact renders this sign of but little value. Splenic cysts are apt to appear laterally under the free border of the ribs, rather than in the deep hypogastric region. They also at times give the perisplenetic friction sound. Neither the pararenal cysts, nor those rare cysts which spring from the remnants of the bodies of Müller or Wölff can be clinically distinguished from adrenal cysts. Blood examinations are of value in differentiating these cysts from echinococcus cysts where there is generally a distinct increase in the eosinophile cells. Bronzing of the skin has not been noted as a symptom.

Treatment.—Operation is of course the appropriate remedy. Complete extirpation is always advisable; but the dangers attending this procedure may be so great that marsupialization may be preferable. For purely diagnostic purposes an aspirating syringe may be employed, but a certain risk attends the aspiration of any abdominal cyst, and it is much wiser to defer any such procedure until the tumor has been exposed by means of an incision. The removal of an adrenal cyst may be accomplished through either an abdominal or a lumbar incision. My own preference is decidedly for a lumbar

incision. The approach through an opening made in the loin is more direct, it avoids the handling of the intraperitoneal organs, which must necessarily take place if the tumor be reached through an abdominal incision, and it offers the most direct route for drainage. The direction of the incision must naturally vary somewhat according to the case, but in a general way, an oblique direction from behind downwards and forwards below the last rib, is the most convenient, such an incision is usual for extirpation of the kidney and ureter. For additional space it may be necessary to remove the last rib.

If the abdominal incision be preferred, the cyst may be approached: *a*, through the lesser omentum (Hadra); *b*, through the ligamentum gastrocolicum (Kronlein, Routier); *c*, through the pancreas recess of Waldeyer.

The main dangers of the operation are hæmorrhage from the pancreas or the larger veins, and injury to the descending colon or to the sympathetic plexus. These cysts are usually very adherent and considerable time is consumed, and blood lost in enucleation of the sac. The adhesions toward the vertebral column and abdominal aorta, are especially troublesome, and in some of the cases subjected to operation have prevented complete removal of the cyst. Severe collapse has followed many of the operations. This may be due to blood lost, time of exposure, shock due to peeling the tumor from the diaphragm or sympathetic nerves, or possibly to poisoning by the adrenal secretion.

The relation of the kidney to these cysts is of interest. In 3 cases it was found at operation so firmly adherent that its removal with the cyst was necessary. In 3 other cases it was quite free and was not disturbed. In all cases except perhaps one it was dislocated downwards.

The loss of one suprarenal gland is quite compatible with life and good health. In animals the loss of both glands means death.

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TOXIC NEPHRITIS DEPENDENT UPON SURGICAL CONDITIONS.*

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IT is not the purpose of this paper to discuss all of the toxic agencies capable of producing nephritis. This is the work of the physician rather than the surgeon.

As long ago as 1874, Vulpian¹ gave expression to the thought that the elimination of vicious products caused by the incomplete or abnormal function of our organs was frequently responsible for irritation of the kidneys and in turn could produce parenchymatous nephritis. To Bouchard, whose first work appeared in France in 1887 and which was subsequently translated and published in this country in 1894, we owe, however, much of our knowledge of the disturbances caused by autointoxication. French, German and Italian investigators and clinicians have given this subject extensive study.

In 1895, there appeared in the *Gazette des Hopitaux* a paper by Gouget,² in which he enumerated the various forms of nephritis dependent upon toxic conditions. Amongst the diseases and conditions thus held responsible he included gout, diabetes, chlorosis, the cachexias, arteriosclerosis, disturbances of the gastro-intestinal tract, pregnancy, hepatic diseases with and without jaundice, myxœdema, exophthalmic goitre and lesions producing suppression of the functions of the skin.

At the Göttingen clinic between 1897 and 1900, 142 cases of nephritis were observed. In 109 the etiology was apparently determined. Of the infectious diseases typhoid was the most common cause, being responsible for 24 of the cases. Scarlet fever, articular rheumatism, diphtheria, influenza, pneu-

* Read before the Medical Society of the State of New York, January, 1907.

monia and tuberculosis were amongst the other infections responsible for this condition.

It has long been known that in septicæmia nephritis is a frequent manifestation. However, the surgical conditions which are capable of producing pathologic changes in the kidneys have not been very carefully studied in the English speaking countries.

It is still an open question whether the presence of bacteria in the urine implies a diseased condition of these organs or whether bacteria can be eliminated by the kidneys without producing any pathologic change in them. The question has arisen whether in this form of nephritis the provoking cause is the bacteria, themselves, or the toxins produced by them.

The experimental work of Pernice and Scagliosi³ shed considerable light on this subject. They experimented with guinea pigs, rabbits and dogs. Bouillon cultures from several microorganisms were used. Histologic examination was made of the kidney tissue while it still possessed living body-warmth, as well as of sections subsequently hardened and again having been boiled for one minute. The animals experimented upon were killed at periods of two, four or six hours after infection and so on up to twenty-four hours. Others were allowed to live forty-eight or sixty hours and some as long as fifteen days after inoculation. The existing conditions at these specified times were carefully studied. The bacillus of anthrax, as well as the bacillus pyocyaneus and the staphylococcus pyogenes aureus were used. Subsequently, animals were inoculated with filtrates of cultures of these bacteria and a comparison of the pathologic changes produced by the inoculation of the bacteria themselves and of their toxins was made.

They state that Cornil and Babes had called attention to the favorable arrangement of the vessels in the glomeruli for the retention of microorganisms. The fact is also emphasized that after bacteria can no longer be discovered in the kidneys, the changes provoked by them may continue to progress.

Their final conclusions are: First, That in cases of general infection, the passage of bacteria through the kidneys produces

various anatomic and pathologic changes in the kidney structure.

Second, The totality of the changes produced by the anthrax bacillus, the bacillus pyocyaneus and the staphylococcus pyogenes aureus furnish a conclusive and positive experimental proof of the production by these bacteria of a glomerulonephritis.

Third, This form of nephritis attacks particularly the cortical structure and only to a limited extent the medullary.

Fourth, The pathologic process begins as an endarteritis with disturbances of circulation inducing hæmorrhages and then causes alterations in the Malpighian glomeruli, Bowman's capsules and the epithelium of the convoluted and straight uriniferous tubules.

Fifth, With alteration of the epithelium occurs exfoliation and occlusion of the tubules, agglutination of the walls resembling hyperplasia of the intertubular connective tissue. In the event of a cure there is a reconstruction of the tubules and a regeneration of tissue.

Sixth, In the pathogenesis of this form of nephritis the bacteria which produce the general infection are the most important factors, but as excitants of the process the toxins of these bacteria play an important role; and in the event of their virulence or great abundance these toxins are alone capable of exciting the diseased process even to a severe degree, provided they enter the blood and reach the kidneys.

It appears then, that in nature's effort to throw off the existing infection, the kidneys which are called upon in part to excrete the same, become a receptacle of bacteria and their toxins, which having been conveyed through the arterial blood to the glomeruli in the renal cortex, are transuded into the surrounding capsule of Bowman and thence into the uriniferous tubules. For this reason this form of nephritis particularly affects the cortex, and only to a limited extent the medullary structure of the kidneys.

Dr. Geo. Sittman⁴ at a later period, and he says without knowledge of the work of Pernice and Scagliosi, carried on

pathologic studies of a similar nature directed particularly to the excretion of staphylococci by the kidneys. He gives in detail his method of injection of the germs into the circulation and states that he established the identity of those obtained in the kidneys and urine by cultures on gelatine and agar as well in bouillon. He determined furthermore their pyogenic character by the inoculation of the anterior chamber of the eyes of rabbits. He reviews the work of other investigators and shows that, while in the course of an infectious disease nature attempts to rid herself of the infection through the skin and various secretions as the milk and bile, it is the kidneys which must particularly assume the burden of carrying off the infection. He contends that he has demonstrated by a number of experiments that pathologic staphylococci can appear in the urine when the lesion is not only slight, but where apparently no damage at all has been done to the kidneys. His experiments were largely upon rabbits. Careful examination of the urine was made to determine whether the microorganisms were present in the urine or only in the blood which had been excreted with the urine. Based upon fifteen experiments the conclusions drawn are that staphylococci circulating in the blood are excreted by the kidneys; that the extent of the appearance of these microorganisms in the urine depends upon the virulence of the infection; that while in milder infections their secretion may cease at the end of fourteen hours, in the severe ones they continue at least forty-six hours and in extreme cases until the death of the animal; that both microorganisms and the toxins are thus eliminated.

In the same volume appears an article by Engel on "Experimentelle Untersuchungen ueber Bacteriurie bei Nephritiden." This article contains a summary of the labors of a good many different investigators to which only reference need be made. It also includes the work of the author based upon the study of thirty-one cases of nephritis occurring in both sexes.

A specific coccus is described to which is attributed the occurrence of a primary form of bacterial nephritis. This was

found seventeen times. A similar claim for the existence of a particular bacillus capable of provoking a definite form of primary bacillary nephritis was made by Letzerich ⁵ as long ago as 1887.

Engel also discovered the staphylococcus pyogenes albus and aureus sixteen times, a streptococcus which rendered bouillon turbid six times, one which rendered it clear twice, the tubercle bacillus four times, the typhoid bacillus once, the bacillus coli communis five times, while bacteria were absent but twice. In his conclusions he quotes Neuman ⁶ and endorses his statement that "despite the presence of bacilli in the kidneys these cases are not of bacterial, but of toxic origin."

An interesting summary of the effect of the injection of the filtered cultures of staphylococci upon the kidneys can be found in the work of Kolle and Wasserman, Bd. III. The changes described are attributed to a coagulation necrosis dependent upon the production of an infarct and the destruction of the leukocytes due to the production of leukocidin. The kidneys were alike affected whether the toxins were introduced into the pleural or peritoneal cavity or into the veins. Minute abscesses ranging from the size of a pinhead to that of a pea were found in the kidneys, particularly in the cortex. Leukocidin could only be produced when hemolysin was present, yet it seems to be proven that they are two entirely distinct poisons.

The investigations along this line have not been very numerous in this country. In 1897 Councilman ⁷ published an anatomical and bacteriological study of forty-nine cases of acute and sub-acute nephritis with special reference to the glomerular lesions. He argues that the most scientific classification of kidney diseases is one based on the etiology, but states that the time is not ripe for the adoption of such a classification. While in general septicæmia, bacteria have been discovered in the kidneys, he states that various microorganisms have produced apparently the same pathologic changes in these organs and the same organisms seem to be associated often with widely different anatomic lesions. He believes that all lesions positively

dependent upon bacteria are focal; the changes they produce in the kidney being in the immediate sphere of the bacteria. The diffuseness of a kidney lesion he argues indicates its dependence upon substances in solution in the blood, namely, the chemical products of bacteria. Moreover, he calls attention to the toxins which are produced in the gastro-intestinal tract, stating, "that chemical substances may be produced in the alimentary canal or by the imperfect action of some organ in the body which may exert a deleterious action on the kidneys."

A very interesting and thoroughly scientific discussion of nephritis was held by the Chicago Academy of Medicine, February 10, 1899.⁸ The papers of Drs. Preble, Walls, Turck and Wesemer are worthy of our careful study. The biochemistry of the various toxic products and their effect upon the kidneys was considered. The effect upon the kidneys of those toxic substances produced in the digestive tract was discussed. It was asserted that atony or arrested function of the gastro-intestinal tract invariably results in the retention of materials which undergo decomposition and then affect the kidneys because of their toxic character.

That cases of bacterial or toxic nephritis present rather a favorable prognosis if the primary disturbance can be relieved appears in a paper by Mannaberg.⁹ In eleven cases which he believed to be of streptococcic origin the germs were found present in the urine in eight. Of the eleven cases seven recovered, one improved and three died. His paper also contains a statement of his experimental work.

As bearing upon this question I report three cases. The first one presumably of staphylococcic infection, in which the patient suffered from septic endocarditis as well as nephritis; the second a case of intestinal obstruction without septic disturbance of any kind and in which in consequence of the complete arrest of intestinal function a very serious and all but fatal form of nephritis was awakened; the third in which there was, complicating gall-stone disease, a sub-acute pancreatitis, and in consequence of the disturbance of the secretory function of this gland a toxic condition was aroused, causing not only nephritis

but also glycosuria. In each of the three cases after removal of the causal condition all evidence of renal disease disappeared.

CASE I.—*Sloughing submucous fibroids; septicæmia; endocarditis; nephritis; expulsion of fibroids; subsidence of septic manifestations; recovery.*

Miss L.; aged forty; school teacher; unmarried; consulted me March 1, 1896. There was a negative family and personal history. Since December, 1896, she had suffered from profuse menstruation unattended by pain. The flow continued usually for ten days. An examination made by Dr. Juliet E. Hanchett showed that she was suffering from fibroid tumors of the uterus. Radical operation was refused and expectant treatment with medication and electricity was instituted.

I saw her again fourteen months later, namely, in May, 1899, when she reported a very marked improvement as to the hæmorrhage. The uterus had, however, increased in size and reached nearly to the umbilicus. I did not see her again until September 6, 1901, at which time the uterus reached fully as high as the umbilicus; was a hard, irregular mass; but freely movable.

When I was next called to see her, September 8, 1905, she was at the Syracuse Hospital for Women and Children, suffering from profound sepsis. She had been spending her vacation on Oneida Lake and had returned home three weeks before feeling exhausted and suffering from fever and diarrhœal movements.

When Dr. Charles F. Wiley was called he found her menstruating. The flow was very profuse; it was of dark color and had an offensive odor. In the discharge there were small pieces of pale tissue. The spleen was slightly enlarged; the skin was jaundiced, as were also the conjunctivæ. There were systolic murmurs to be heard over the entire præcordial area. The diarrhœa continued about ten days. The blood was examined on August 24. The Widal reaction was negative. At this time each cubic millimeter contained 4,200,000 red and 20,000 white cells, while the hæmoglobin percentage was 47.

During this period there were sharp remissions of temperature. The morning recession would be about to normal, the evening rise from 103.2 to 105.4 degrees F. The pulse rate during this period was from 90 to 100. At this time the urine was repeatedly examined and found to be amber, cloudy, acid, had a

specific gravity usually of 1028, contained no sugar but had a large percentage of albumin and microscopically hyaline and granular casts, epithelial cells, red blood and pus cells were found. For the purpose of examination the urine was drawn by catheter. The vaginal discharge was profuse, and repeated examinations bacteriologically discovered each time the staphylococcus pyogenes aureus.

On September 7 the patient expelled from the uterus with severe pain a mass which was sent to the pathologist, Dr. Steensland for examination. His report was as follows:

"The specimen has two flattened surfaces; is nearly circular. Its surface is very irregular, presenting depressions and elevations. It measures 6.3 by 5 by 3 cm. and weighs 43 grammes. It is elastic to the touch, but in some parts more firm. Its general color is white with yellowish semi-plastic material on the surface in some places. On section the cut surface shows numerous blood vessels and bands of dense fibrous tissue separating the irregular areas of reddish softer tissue. The parts firm to the touch, as mentioned above, contain relatively more fibrous tissue than the elastic parts. Diagnosis, necrotic leiomyoma."

With the expulsion of the growth, the temperature fell so that for two days it did not go above 102.6. Pus was discharged more profusely.

This was the condition when I saw her on September 8, 1905. The anæmia was very striking. There was extreme pallor of the mucous membrane, while the complexion was very sallow. Examination of the surface of the body did not show any petechiæ. There had been no hæmorrhage from any organ. Over the entire præcordial area loud blowing murmurs could be heard. The uterus reached above the level of the umbilicus. The uterine cervical canal was sufficiently patent to receive my index finger and the presence of a soft mass occupying the cavity of the uterus could be readily made out. Blood examination showed a leukocytosis of between 22,000 and 23,000 and the hæmoglobin had fallen to 40 per cent. The urine was loaded with albumin and casts. The pulse ranged from 90 to 100. During the next few days the temperature each afternoon was between 103 and 104, while that of the morning was normal. She suffered daily from recurring chills and profuse sweats.

On the thirteenth her condition not improving I placed her

upon the operating table and found an enormous mass trying to deliver itself from the uterine cavity. I attempted to stretch the already dilated cervix sufficiently to permit it to expel the tumor but my efforts were ineffectual. Because of the septic condition I did not deem it wise to make a section of the cervix. I introduced a flushing curette for the purpose of washing out the uterus. Immediately upon its introduction there was a discharge of at least a pint, if not a quart of stinking pus. The uterus was then washed out. A heavy rubber drainage tube was introduced for the double purpose of permitting drainage and stimulating the uterus to contraction. In consequence, not only was the uterus drained of pus but three days later the patient expelled another tumor more than twice the size of the former one and of the same character. The temperature fell at once to normal and there was no further recurrence of fever. Immediately improvement in her general condition became apparent. She was able to take food. The blood improved in character so that three and one-half weeks later when she was dismissed from the hospital a blood examination showed 4,968,000 red and 12,000 white cells to be present and the hæmoglobin to have come up to 75 per cent.

On September 22, the urine still contained a trace of albumin, but no casts. On October 21, 1905, the urine was straw colored, clear, acid, 1020, contained no albumin nor sugar, earthy phosphates were normal, total 8 per cent.; microscopically there were a few squamous epithelia and amorphous urates. At that time I found the heart sounds normal. Bi-manual examination of the uterus showed it to be slightly enlarged reaching just above the pubis and the fundus soft. There was a small fibroid, at the junction of the cervix with the fundus on the anterior wall. The tubes were normal. Since then she has continued to remain in perfect health. The urine has been repeatedly examined and every time found to be normal.

CASE II.—*Intestinal obstruction due to adhesions and bands; pronounced nephritis; uræmic convulsions; recovery.*

Mrs. W., a resident of Johnson City, Tennessee, was called to her mother's home in Cazenovia, N. Y., on January 9, 1906. She was forty-five years of age, the mother of three children, the oldest 23 and the youngest 10. There was a negative family history.

For more than 25 years she had been having recurring attacks of severe constipation amounting almost to complete obstruction, but each time was relieved by cathartics and enemata.

On her way north she was seized with severe abdominal pain and distress. Upon her arrival in Cazenovia on the evening of January 5, Dr. Walsh of that village was called to see her. He gave her a hypodermic injection of morphine to relieve her pain. On the following day, January 6, she vomited continuously, the vomited material, however, being of bilious character. No movement of the bowels could be obtained. On January 7, the vomiting still persisted. During the morning it was greenish in color but in the afternoon it became stercoraceous. Saline and other cathartics as well as enemata had been given her without avail. Her condition grew steadily worse until I saw her on the morning of January 9, 1906. At that time I found the pulse 120 and very feeble, no fever, marked distention of the abdomen, some sensitiveness over the right side but no rigidity. The facilities for operation there were poor, and so she was placed upon a cot-bed and brought by train a distance of more than twenty miles to St. Joseph's Hospital, Syracuse. This was at mid-day. A specimen of urine obtained by catheterization upon her arrival at the hospital was found to be amber, acid, sp. gr. 1022, contained no sugar, 5 per cent. of albumin by the ferrocyanide test, hyaline and granular casts, squamous epithelium as well as round and spindle cells and granular debris. A tube was introduced into the stomach, and about a pint of thin fecal matter was withdrawn. The pulse in the meantime had become so feeble and the respirations so shallow that it was impossible to give the patient a general anæsthetic. An intravenous injection of the normal salt solution was therefore administered. This improved the condition at once, so that I could operate, being assisted by Dr. Flaherty.

On opening the abdomen the presenting intestines were found to be darkly congested. There was some bloody serum in the abdominal cavity. The obstruction was found to be in the right iliac fossa, where a broad band connected with a very large ovarian mass was found under which a loop of gut had become twisted in the shape of a figure eight. The band was cut and the ovarian tumor removed. Various other bands of adhesion not directly concerned in the obstruction were severed. The abdomen was closed without drainage. Six ounces of deci-

normal salt solution, with two of whiskey were given per rectum as well as caffeine, spartein and digitalis hypodermically. She continued to vomit frequently until three o'clock on the following day. The vomited material was of fæcal character during the night, but in the morning became bilious. The bowels moved voluntarily twice on the day after the operation. The urine was of sufficient quantity during the first twenty-four hours but was highly albuminous and contained hyaline and granular casts. The only serious symptoms the patient experienced after operation were due to the renal condition.

On January 12 the urine became much less abundant and still contained six per cent. of albumin, had a sp. gr. of 1030, and casts were very numerous. During the night between the twelfth and the thirteenth the urine became practically suppressed, and on the following morning we were confronted with a condition of anuria associated with evidences of uræmic toxæmia. At my request the house surgeon gave the patient another intravenous injection of normal salt solution and an hour later the pulse improved and the urine was again excreted, although the patient had a general convulsion of uræmic character in the meantime. Dr. Elsner, who saw her in consultation with me, suggested the use of digalen. Large quantities of the decinormal salt solution were also given per rectum with the cistern placed just above the level of the bed. A satisfactory discharge of urine resulted, but the percentage of albumin did not vary much from $4\frac{1}{2}$ to 6 per cent. The sp. gr., however, became somewhat lower, ranging from 1018 to 1020. There was always a large number of casts and usually leukocytes and red blood cells present.

On the thirteenth, 7 per cent. of albumin was recorded with a sp. gr. of 1010. On the following day it was but 3 per cent. and after that the sp. gr. ranged only from 1006 to 1010. The percentage of albumin was not, however, materially reduced nor were the casts less evident until January 25, namely, sixteen days after operation. There followed a very rapid change, and four days later the albumin had entirely disappeared as had also the casts. The sp. gr. continued very low, rarely exceeding 1010 for the next two weeks, but after this date it, as well as the other features of the urine, became normal and continued so. The patient returned to her home in Tennessee, and as far as I have been informed has remained perfectly well.

CASE III.—*Cholecystitis with gall-stones; sub-acute pancreatitis associated with nephritis and glycosuria; operation; recovery.*

Mrs. B., aged thirty; seen in consultation with Dr. Levy, November 21, 1906. She had a history of gall-stone disease covering a period of six years. Her present attack was of five weeks duration. During this time she had been quite prostrated, suffering continuously, and required the frequent administration of morphine hypodermically. There was no fever; jaundice was marked; tenderness over the gall-bladder was considerable. A specimen of urine drawn by catheter was found to be of dark amber color, clear, sharply acid, 1032, contained two per cent. of albumin and two and one-half per cent. of sugar, some bile, total phosphates eight per cent., earthy phosphates normal; microscopically a great abundance of squamous epithelia, a large number of both hyaline and granular casts, some pus cells and uric acid. She was admitted into St. Joseph's Hospital and observed for a few days, but her condition did not improve. The urine on repeated examination was found to present the same characteristics.

On November 25, assisted by Dr. Flaherty, I operated upon the patient. The gall-bladder was found to be somewhat distended with bile, which on subsequent bacteriologic examination was found to contain the bacillus coli communis. A single gall-stone was present. It was removed. The gall-bladder was implicated in a hard infiltrating mass which included the common duct and the pancreas. The latter gland was quite hard and firmly adherent to the surrounding structures. A drainage tube was introduced into the gall-bladder and the wound closed. Gauze tapes were packed around the gall-bladder at points where the tissue had been torn by manipulation. While the gauze tapes remained the patient had an irritable stomach and vomited considerably, but upon their withdrawal the vomiting ceased. For the next twenty-four hours the urinary excretion amounted to 24 ounces; during the second to 20 ounces. Digalen, citrate of potassium and saline cathartics were prescribed and fluids both by mouth and rectum freely administered; for the latter purpose the decinormal salt solution being used. The urine on November 30 was found to be dark amber, clear, acid, had a sp. gr. of 1030, still contained bile, total phosphates were 12

per cent., earthy phosphates normal and both sugar and albumin had disappeared; there were a few crystals of uric acid and an occasional hyaline cast. On December 3 the urine was entirely normal. From this time on the patient continued to steadily improve. Drainage of the gall-bladder was kept up for five weeks, at the end of which time the wound was ready to close, and did promptly. The urine continues normal and there is no evidence of any renal disturbance.

The subject of nephritis, dependent upon truly surgical conditions located quite remotely from the kidneys, is one to which not sufficient attention has been given by the profession, at least in this country.

In our first case we had a bacterial or toxic nephritis dependent upon a septic condition and associated with other evidences of profound sepsis, especially the changes in the heart. The patient's condition was exceedingly precarious, and yet after the expulsion of the fibroids and the subsidence of the sepsis of the uterus, there was at once a prompt recovery from the secondary disturbance both in the heart and kidneys.

In our second case, evidently the result of interruption of intestinal function, a toxic condition was created within the intestinal tract and, as a result of this toxæmia, we had a pure toxic nephritis. This was so extreme that we were confronted by a graver danger after having relieved the acute intestinal obstruction. The patient's life was almost extinguished in consequence of the nephritis. Here also the nephritis was cleared up by the relief of the surgical condition.

Our third case presents still another phase, namely, one in which a large secretory gland, because of its inflamed condition due to gall-stone disease, created a toxic condition which awakened not only toxic nephritis but glycosuria as well. In this case the subsidence of the nephritis disturbance was even more prompt than in the other two cases.

It is generally held that the presence of nephritis is to be regarded as a possible and oftentimes a serious contraindication to surgical operation. It seems to me that in the class of cases presented for your consideration in this paper the bacterial or

toxic nephritis becomes rather a most positive indication for operation, as by such a course only can it be relieved.

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THE DIAGNOSIS OF OBSCURE CASES OF RENAL AND URETERAL CALCULUS.

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THE importance to the patient and to the surgeon of an accurate diagnosis as to the presence or absence of calculus in the kidney, or ureter, and of the exact location of the calculus when its removal is contemplated, entitles this subject to attention.

Calculus in the kidney, in a calix or a dilated pelvis, may be exceedingly difficult to find at operation, with the kidney delivered and in full view. In such a case, it is impossible often to palpate a stone of the size of a black bean ($\frac{1}{2}$ inch by $\frac{1}{4}$ inch by $\frac{1}{4}$ inch) through the lips of the hilum, and such a calculus may easily be displaced upward or downward into a calix so that palpation through the kidney substance, or by means of a finger inserted into an opening in the pelvis (which finger-tip cannot be made to enter the calix), may fail to discover it, and splitting the kidney from end to end opening into all calices may, in extreme cases, be necessary. Needling, probing, etc., may also fail.

Calculus in the abdominal ureter, and at the lower extremity of the ureter when in the intramural portion, is quite accessible for removal, while one situated one or two inches above the bladder wall in the pelvic ureter involves an operation for its removal which is classed among the most difficult of surgical procedures. Even a Kraske mutilation has been proposed for access to this part of the ureter.

If the calculus is not found in the kidney, but an obstruction is found by a ureteral probe passed down from the pelvis, a prolongation of the operation through a second incision for access to this part, or a deferred second operation, is necessary.

To safeguard the patient from unnecessarily mutilating operations and to avoid long and, as has all too frequently been the case, even fruitless search, a definite conclusion as to the site of the calculus should be painstakingly sought before operation is advised.

In many cases it is by no means simple to differentiate infected calculus disease from other diseases of the kidney and its pelvis, such as pyelitis, pyelonephritis, pyonephrosis and tuberculosis, or from vesical tuberculosis and prostatitis, and the cases without pyuria from renal neoplasm and some forms of nephritis or from diseases of neighboring organs, such as cholecystitis, cholelithiasis, pancreatitis, pancreatic calculus, gastric disease, intestinal colics, appendicitis, ovarian and tubal disease.

Typical cases of nephrolithiasis may present features from which a diagnosis is speedily reached, but not infrequently all the means at command must be brought to bear to definitely conclude upon the cause of the symptoms and the site of the calculus.

A calculus in the lower ureter may, and not infrequently, does give rise to subjective symptoms, precisely the same as those caused by a calculus high in the upper pole of the kidney. This fact is frequently overlooked by surgeons who depend upon the history, physical signs and radiographs of the kidney only, and, finding no shadow after a satisfactory series of plates, conclude that nephrolithiasis can be excluded.

Lumbago, sciatica, chronic appendicitis, peritoneal adhesions, chronic cholecystitis, tubal and ovarian disease are explanations given to patients to help them bear the pains of renal and ureteral calculi because of incomplete examination. Within the past year the writer has seen patients upon each of whom one of these diagnoses has been made, each of whom has borne his suffering for years—some of them have undergone operation—after which recurrence of the familiar pain has been ascribed to another of the list, usually to the common peritoneal adhesion.

It is the duty of the urinary surgeon to make clear the diagnosis in these cases. This is possible in practically every

case. Yet, with all our means of determining a diagnosis, there are cases which are baffling. An outline of procedure is as follows: 1. History; 2. Examination of urine; 3. Physical examination; 4. X-ray examination; 5. Special instrumentation.

History.—The main subjective symptoms of cases of suspected nephrolithiasis may be classed, for brevity, under two heads: (1) Pain, and (2) Changes in urination, *i.e.*, disturbance of function and alteration in the character of the urine. Pain may be entirely absent or there may have been, in the past, a scarcely remembered discomfort which lasted but a short time, and these cases lead their advisers to conclude often that, without renal colic, no renal calculus can exist. No one symptom is so deceptive in this condition as the description of pain which patients give. Pain in the spine, weakness of the back, aching in the ilium, lumbago, sciatica, are commonly described, by one as mild, by another as agonizing. The severity and character of pain have doubtless, in great part, a direct relation to the traumatism done by the movement of the calculus or the distention of the pelvis and ureter above a partial or complete obstruction, and the back pressure produced thereby upon the kidney, which secretes under difficulty and, we may reasonably presume, becomes hyperæmic or congested, with consequent distention of its capsule. A cramp contraction (tonic spasm) of the muscular coat of the pelvis and ureter, combined with traumatism to the mucous membrane, accounts for ureteral colic. This pain is often reflexly felt along the distribution of the ilio-inguinal, genito-crural, and sciatic nerves. The character of the calculus has much to do with the severity of the pain and the traumatism produced. A sharp or rough calculus (as many calcium oxalate and phosphatic calculi) the size of a pin-head, may produce the most agonizing colic, while a smooth surfaced stone, nearly as large as a cherry, may be borne in the pelvis, or ureter, without severe pain throughout life. Either of these may give rise to any of the pathological conditions consequent upon partial urinary obstruction, such as dilation above it with infection sooner or

later, as usually occurs wherever a stasis of urine is found.

Calculus in the kidney, in a calix, or in the pelvis, produces pain which is referred to the kidney region and all along the ureter, which shares in the spasm set up by efforts to expel it from above.

The site of pain (not colic) may be said to be either at the point of obstruction by the calculus or above it, commonly, of course, at the site of the calculus; but, in some cases, this point is neither referred to as the most painful area, nor is there great tenderness on palpation of a calculus. The greatest pain is often referred to the region of the kidney, or along the ureter above the situation of the calculus when it is in the ureter.

Changes in urination consist in disturbances of this function and alterations in the character of the urine. The functional disturbances are painful, frequent, or irregular, imperative demands for urination, or there may be infrequent urination—oliguria; anuria.

Either typical renal calculus pain, or change in urination, and in the character of the urine, may be absent from the history. These cases, in which the two cardinal symptoms are not combined, form a large class, and are frequently told that renal calculus can be excluded. Those who have right-sided pain, without urinary symptoms, are not uncommonly subjected to appendectomy and exploratory laparotomy for examination of the gall-bladder and bile ducts, or to search for the wary peritoneal adhesions or, in the female, undergo pelvic operations for purposes of investigation.

Those who complain of disturbance of urination, or show gross changes in the urine, are more fortunate in having attention immediately called to the urinary tract.

The importance of the careful examination of centrifugated urine, when the suspicion of renal calculus has been aroused, has been repeatedly emphasized. The failure to carry out completely this part of the examination accounts for many failures in diagnosis. It is, however, common observation that a renal colic, due to calculus, is accompanied by, and subse-

quently shows, no trace of red blood cells in carefully examined specimens. This is explainable when a smooth surfaced calculus causes no trauma upon the mucous membrane and the muscular spasm of the pelvis and ureter has not produced such squeezing of the mucous membrane that rupture, or diapedesis, results.

Calculus situated above the lower pelvic ureter may never give rise to frequent or painful urination, while calculus in that portion near the bladder, especially when in the intramural portion, almost invariably sets up spasmodic contractions of the viscus, such as are caused by prostatic or urethral disease. Renal and ureteral colic may communicate the muscular spasm to the bladder, and calculus disease seems, at times, to cause vesical irritability without recognizable changes in the bladder or in the chemical or microscopic character of the urine.

In purulent urine, of whatever origin, red blood cells are commonly encountered, but are often difficult to distinguish in the fields of pus under the microscope, so that, in the infected cases, a minute quantity of blood is an ambiguous sign. In aseptic cases, however, great significance can be attributed to a few red blood cells found in voluntarily passed urine. The use of a soft rubber catheter may, in the most skillful hands, cause sufficient trauma to the delicate mucous membrane about the sphincter, along the posterior urethra, or upon the floor of the bladder, to show red blood cells in a specimen drawn in this way—consequently, we must place most reliance in the finding of hæmaturia upon specimens passed voluntarily under precautions of cleanliness. In women, this may require a special technique.

There are some who assert that, in many cases, the character (size and shape) of epithelial cells, found in urine, give a definite clue as to the site of a lesion, situation of a calculus, etc. This is doubtless true in cases where a marked preponderance of one type of cells is found, but the opinion of many competent clinical pathologists seems to be that this is rarely the case in surgical urinary affections. Certain types of crystals are said also to preponderate with calculus of uric acid, calcium

oxalate, or phosphate, respectively. In looking over some of the reports of others, and of our own, we find that the crystals found in urine often do not at all correspond in nature with that of a calculus present. Phosphatic deposits are as often found in urine where a uric acid calculus exists, as urate or uric acid deposits; and uric acid, urates and oxalates are found in cases which carry phosphatic calculus, so that we are led to question a diagnosis of the variety of calculus based upon the variety of crystals appearing in the urine.

Physical Examination.—Physical examination, as ordinarily meant by inspection, palpation and percussion, gives ample resource for the investigation of the cause and seat of disease, and should be carried out with careful record of the signs which it gives. Yet the history, urine examination, and physical examination, efficiently made, do not afford conclusive evidence of the presence of a calculus and its location.

Localized tenderness is usually elicited when pressure is exerted upon the site of a calculus. A localized point of tenderness will often mislead if it is not clearly recognized that there may be no especial tenderness at the site of the calculus but great pain on palpation over the distended or diseased portion of the tract above the obstruction. When a calculus projects from a ureter mouth into the bladder, it may be palpated by rectum or vagina, touched by a sound or searcher, transmitting the characteristic sensation to the finger and heard by the ear, and also it is plainly visible by the cystoscope.

It is certainly a rare experience for a surgeon to palpate a calculus, or several calculi, in the kidney. Calculus in the abdominal ureter is rarely found on palpation. In very thin, or lax-walled bodies, this is possible at times. Calculus, in the pelvic ureter, is palpable by rectum, in the male, only when lying immediately above or in the intramural portion of the ureter. Between the crossing of the iliac vessels and the vesical juncture, there is an extent of ureter of approximately 10 cm.—nearly four inches—which in the male, and in most females, is out of reach of the palpating finger.

X-Ray Examination.—By this means a positive diagnosis

of calculus in the kidney, renal pelvis, or ureter, can be made, for the reason that this, when positive, is a physical demonstration as certain as direct eyesight.

The Röntgen-ray has proved to be of inestimable value as a diagnostic aid, especially for lesions of bones and for the discovery of urinary calculi. It is essential for complete examination when urinary calculus is suspected. Without it, no combination of other signs is convincing—yet it has limitations. Hardly more demand must be made upon this form of clinical research than is made upon others which are older and whose value and limitations are now recognized by all.

No reasonable physician expects a positive exclusion of tuberculosis because tubercle bacilli are not found in sputum or urine, when signs give weight to this suspicion. So we cannot positively state that calculus does not exist in the urinary tract after several satisfactory plates are obtained of each part of the tract. I believe, after some experience in radiography, that a positive statement that calculus can be excluded, by reason of any X-ray examination, is unwarranted. Fortunately, it is only rarely that the pure uric acid, or urate calculus, exists. I recently saw a large calculus in a bladder by means of the cystoscope, and was astonished to obtain clear plates of the pelvis, showing no shadow which might, of itself, arouse the suspicion of calculus. In order not to judge my own X-ray results as conclusive, this patient was sent to Dr. E. W. Caldwell, and his plates, he frankly stated, would not have led him to make the statement that calculus existed, had he not known of its presence. A very short exposure, with a very low tube, brought out a shadow, which we could recognize as that of the calculus, after its removal by cystotomy. This point is of such importance that a description of this large vesical calculus is given. It is a bi-convex disc, reddish brown in color—measuring 51 by 46 by 22 mm., weighing 42.2 grams—composed of uric acid in its periphery, and uric acid and sodium urate in its center. This, and other experiences, lead me to believe that some cases harbor calculus which have been positively stated to be calculus free.

Some experiments with calculi which had been carefully analyzed, as well as with the pure powders of the various constituents of calculi, give me reason to doubt the possibility of obtaining shadows of calculi composed of uric acid or urates, without admixture of other salts. A uric acid calculus, having a very slight admixture of oxalate, phosphate, or carbonate, or a very thin coating of any of these salts, can be demonstrated clearly.

The plates, which failed to reveal a recognizable shadow of the large calculus mentioned, show the coccyx quite distinctly to its tip, and this calculus covered this bone at the time.

Pure uric acid, sodium urate, and ammonium urate, absorb very little of the X-ray and give a barely recognizable shadow even when placed directly upon the plate. Most uric acid, and urate calculi, have some oxalate salt in or upon them—often a bare trace only upon analysis—yet this is sufficient to give them resistance to, or absorption of X-rays and a definite shadow upon a plate.

The X-ray examination, however, in the great majority of cases, is competent to show accurately the size, shape and location of a calculus in any part of the urinary tract in practically every individual, without regard to size, adipose or muscular development. In favorable subjects, we should get the shadow of the kidney and be able to determine very accurately the position of a calculus in it, *i.e.*, whether the calculus lies in the pelvis, in an upper or lower calix, or far out in the renal parenchyma. The importance of this accuracy is appreciated when the number of cases in which the search by palpation, needling, probing, and splitting, is carried on, and even abandoned without removal of the object sought.

If the surgical work can be limited to a small part of the kidney, or to the pelvis, without resort to examination first of parts where we can be sure the calculus does not lie, an advantage is gained.

I have recently seen patients who have been subjected to operation during which the calculus was not found after prolonged search, whose symptoms have naturally persisted and in

whom the calculus could still be clearly demonstrated upon radiographs.

The deceptive shadows, such as those of phleboliths, calcareous deposits in muscles or tendons, calcareous appendices-epiploicæ or dense material found in the intestine frequently, can be excluded positively. Dr. G. E. Brewer's case of calcareous appendix-epiploica, adherent to the wall of the ureter, is in a class by itself and must exist very rarely.

Several (two or more) plates, taken at different times and at different angles, should always be made before a statement as to the situation of and nature of a body casting a shadow upon an X-ray plate, is made.

This does not involve risk to the patient, so far as deleterious effects from X-rays are concerned, if exposures are short—not over two minutes in all—for several plates, and should involve shorter exposure-time wherever practicable. Satisfactory X-ray plates can only be obtained when the intestinal tract is practically empty. We should get a shadow of the kidney itself—the normal kidney even—and, in plates of the pelvis, should show the coccyx to its tip as well as obtaining the detail of thick muscle and bone extremities demanded by judges of X-ray plates in order to consider this examination satisfactory.

The cause of the impossibility, as I believe, even in small and thin subjects, of showing the presence of the pure uric acid, or urate calculi, by means of X-ray and because of the uncertainty of any combination of symptoms, and in many cases also the baffling evidence, or lack of evidence, elicited by the physical signs, we must resort to special methods for aids in determining the diagnosis.

Special Instrumentation.—The data obtained by a cystoscopic examination of the bladder often give very strong evidence of the presence of calculus in the ureter. When hæmorrhage, or pyuria, occurs in these cases, we usually have pain as a symptom to guide us to the suspected side and may see the dark or cloudy jet from that ureter mouth.

A calculus projecting through the ureter mouth may be easily seen. A calculus, just within the ureter mouth, gives a

marked tumefaction of the mucous membrane all about the mouth of the ureter. A calculus still higher in the ureter, *i.e.*, above the intramural portion, may produce no change visible at the mouth and yet it may be the cause of a hyperæmia or œdema, or protrusion (prolapse) of the mucous membrane, with or without petechial points, because of the frequently repeated physiologic efforts to expel the foreign substance.

Not too much reliance can be placed upon "ureteric meatoscopy" for real evidence as to the condition above the mouth of the ureter. The appearance of the ureteric meatus gives grounds for valuable suspicions—rarely is it evidence.

The catheterization of both ureters at the same time, for the collection of a sufficient quantity (10–30 c.c.) of the excretion of each kidney for comparative chemical, microscopical, bacteriological (including cultures) and physical examinations, gives most important data, aiding in determining the pathologic condition of the affected tract and the condition of the other and in pointing to the surgical procedure to follow.

A kidney, irritated by a concretion, seems to be stimulated to great activity (unilateral polyuria)—an effort no doubt to expel the offender when there is an open course through the ureter. Its functional activity also seems to be impaired, for the amount of solids excreted in the urine from such a kidney usually compares unfavorably with that of its fellow.

Abnormal constituents, or a relatively abnormal amount of epithelium, from the pelvis and from the tubules (catarrhal pyelitis) may be obtained from the affected ureter and, while hæmorrhage is occurring or if infection has already occurred, blood and pus will demonstrate these conditions.

When nephrectomy is contemplated, the importance of knowing that the other kidney exists and is functionally competent is obvious. To "take the chance" that it is present and vigorous, and then have the autopsy reveal its absence or pathologic condition is not good surgery.

The necessary time, trouble and discomfort devoted to cystoscopic and ureter examination before operation are amply compensated for when, during a proposed nephrotomy, uncon-

trollable hæmorrhage or an unsuspected condition of the kidney make the removal of the entire organ necessary.

After some experience with the cryoscopy test, I have been led to the conclusion that the determination of the freezing points of the separate renal products gives us no more reliable knowledge of the comparative capabilities of the kidneys than is brought out by the complete chemical and microscopic examinations, which should never be omitted.

Ureter-Catheter as a Probe.—The ureter-catheter may give strong indications of the presence of a calculus by coming in contact with it in the ureter and being obstructed in its advance upward. This, too, is frequently a pitfall because of the readiness of the catheter to become caught in a fold of mucous membrane, or to fail to follow the course of its lumen because of its stiffness, or too great flexibility. The catheter is at times obstructed by a stricture, which may have no relation to the site of the present calculus. A ureter, harboring a calculus, will very often permit of stretching without pain so that the catheter is easily passed beyond it. This has been done in numerous cases in which calculus has been demonstrated.

It is justifiable to conclude that complete obstruction exists when no jet of urine is seen to issue from the mouth of the ureter during a comparatively long observation, even after hypodermatic injection of indigo-carmin, and when catheters of large and very small calibre refuse to pass beyond the same point and no fluid escapes through any catheter.

Kelly's method of smoothly coating the tip of a catheter with wax and passing it up to or beyond the calculus, so that scratch marks are made into the wax by the hard, rough calculus, is advantageous in many cases, in women especially, with his own method of ureter-catherization, but it is liable to lead to erroneous conclusions when used in the direct-illumination cystoscopes of European or American design, by reason of impressions upon the wax made by the catheter canals in these instruments. By means of the wax-tipped catheter, in suitable cases and in experienced hands, one of the best evidences of the site of calcareous material in a ureter may be obtained.

The phonendophore (metal-tipped auscultatory ureteral bougie), as devised by several men, has been used by me. It is a promising means of searching a ureter and renal pelvis.

A ureter-catheter, bearing a stylette of metal, preferably soft wire of small size, may be passed through the length of the ureter and, as first done by Dr. F. Tilden Brown in 1898, a radiograph immediately taken to show the course of the ureter. A shadow coinciding with this line is, in most instances, a ureteral calculus; yet here error may be made, for this simply represents shadows falling in the antero-posterior plane of the stylette, and any shadow-casting body lying in that plane, from the skin of the abdomen to the skin of the back, may be mistaken for a calculus in the ureter in contact with that stylette. This error can be almost certainly avoided if stereoscopic radiographs are taken of the styleteted catheter in the ureter.

When the calculus obstructs the passage of the catheter through the ureter, or lies in the renal pelvis, the radiograph should show the shadow of the stylette extending up to the obstruction, giving by measurement its distance from the ureter mouth and, by its relations to the body structures shown in the radiograph, an accurate estimate of the point to be attacked surgically.

The distention of the renal pelvis, through a ureter-catheter by injecting fluid until pain is produced, for the purpose of determining whether the subjective sensation of the patient is the same as, or a different experience from that of the attacks from which relief is sought, is not commonly employed, but, at times, has given important additional evidence in doubtful cases. It is occasionally valuable for evidence in making a differential diagnosis from extra-urinary pain.

These details of methods, with some of the weaknesses of each, would seem to make the diagnosis of obscure cases of renal and ureteral calculi not only difficult, but tedious and complicated, and (some will say) in the end leading to no more definite conclusions, so that exploratory operation will be the outcome after all. This may doubtless be true in a very few cases. The condition in the urinary tract, which fails to be

revealed by such an examination, must be rare indeed. And so, in these same cases, exploratory operation will as frequently fail to remove and fail even to reveal the cause. The frequency of exploratory operations in this country appears to me a blot upon American surgery. The usual physical examination, cystoscopy, collection of sufficient quantity of secretion from each kidney, examining the lumen of the ureter, and radiograph, while a styletted catheter lies in the ureter, can all be accomplished at one visit within the space of one hour, with the proper preparation of the patient and the necessary facilities at hand. It is preferable, however, to divide the examination into two or more parts, making the physical examination and cystoscopy at one time, with the ureter and X-ray tests subsequently.

The baffling cases in which a diagnosis cannot be made—so far as our present methods go—are those in which a smooth pure uric acid, or urate calculus, exists without obstructing the flow of urine and without infection. These patients have pain, and we suspect the urinary tract, or they have painless hæmaturia, yet we cannot demonstrate positively the presence, or absence, of calculus. It is, we believe, a rare condition.

I take this opportunity of expressing gratefully my indebtedness to Dr. F. Tilden Brown, with whom I am associated, for opportunities to see many of his cases and for the use of his records in the study of this subject.

TUBERCULOSIS OF THE TESTICLE.

OBSERVATIONS UPON 100 PATIENTS.

BY EDWARD L. KEYES, JR., M.D.,

OF NEW YORK.

THE following observations are based upon the histories of 100 patients suffering from tuberculosis of the testicle, collected from the case reports of our office (including cases observed by Drs. Van Buren, Keyes, Sr., and Chetwood). Fifty-three of these patients were observed after involvement of the second testicle: and my material, therefore, consists of 100 patients bearing 153 tubercular testicles.

Predisposing Causes.—Family tuberculosis was confessed by 27 patients, denied by 14. It is surely more common than these figures would indicate; yet, as a diagnostic point, very little reliance can be placed upon it: for certain pseudo-tubercular, chronic, gonorrhœal inflammations of the epididymis, closely resembling tuberculosis often occur in persons with tubercular antecedents.

The influence of race and of occupation I can not state.

Age at Onset.—The following table shows the age at which the tuberculosis localized itself in the testicle, as compared with the age at which tuberculosis was first noted.

Tuberculosis began. Testis began.

In "youth"	5	—
At 9 years	1	1
At 14 years	1	1
Between 15 and 19 years.....	9	8
Between 20 and 24 years.....	17	14
Between 25 and 29 years.....	24	25
Between 30 and 34 years.....	20	16
Between 35 and 39 years.....	4	10
Between 40 and 44 years.....	7	9
Between 45 and 49 years.....	7	9
Between 50 and 54 years.....	1	0
Between 55 and 58 years.....	2	3
Totals	98	96

In 71 per cent. tuberculosis was first observed between the ages of fifteen and thirty-four, while in 65 per cent. the testis was first attacked between these ages. Inasmuch as it is impossible to regard tuberculosis of the testicle as a separate and distinct lesion apart from tuberculosis elsewhere in the body, and since, as we shall see, the disease may relapse even after years of apparent quiescence, flitting between bone and lung and urinary tract, the date of onset of the tuberculosis is more important than that of its localization in the testis.

Associated Tubercular Lesions.—In 49 cases there was no evidence of any previous tuberculosis when the testis first enlarged; while in 36 cases there were more or less ancient foci of the disease elsewhere in the body.

Tuberculosis of the lung preceded invasion of the testicle 15 times—three years, twelve years (2 cases); many years (2 cases).* Bone or joint tuberculosis preceded eight times—One, two, twelve, many years (2 cases).* Inguinal adenitis preceded twice. Fistula in ano preceded twice. Renal tuberculosis preceded eleven times; prostatic or vesical tuberculosis thirteen times.

Many of these patients showed several localizations of tuberculosis before it attacked the testicle. For example, in one the wrist, ribs, sternum and bladder were invaded in succession, and then the testicle; in another there had been glands in the neck and ischio-rectal abscess; in another Pott's disease and tuberculosis of the prostate; in another phthisis and tubercular kidney. But most important of all is the fact that in no case have I been able to satisfy myself that the testicle was the only organ involved in the tubercular process. Careful examination has always shown one of three conditions—tubercular bacilli in the urine, indurations about the prostate and vesicles, or a distinct haze in the urine due to prostatic catarrh. In this last class of cases the prostatic secretion is always purulent.

I recognize the possibility of primary tuberculosis of the testis, though I have not seen it. I am sure that in

* In the others the interval was brief.

certain of my cases tuberculosis of the testicle has been the only lesion of any moment in a given patient. Yet I am equally sure that in every case I have carefully examined there has been some congestion of prostate or vesicles, or both, at the time of examination; and I am inclined to believe that this congestion is always tubercular. Hence I believe that the tubercular testis is always an index of general tuberculosis of the genital organs.

A very striking confirmation of this fact is that only one of these patients was alledged to have begotten children after involvement of one testicle. I do not know that they were all sterile. But I was surprised, in collecting these cases, to find how many of them, being married, had ceased to beget children a year or two before invasion of the first testicle.

This condition has nothing to do with sexual potency; for only five complained of impotence, though doubtless many others had, at least, a relative decrease in potency.

But it would be very interesting to know whether patients with tuberculosis of only one testis have azoospermia. I have examined but one and in that case could find no spermatozoa in his semen.

Let me, therefore, present as a matter for future research, the examination of the seminal fluid of every case of unilateral, testicular tuberculosis.

But one patient is reported to have begotten children:

The patient came to my father in 1888 with a history of spontaneous epididymitis on both sides. Examination revealed suppuration in both epididymes. The condition of the internal genitals is not noted. He was a casual youth, twenty-one years of age; he visited the office only twice or thrice, and then drifted away.

Twelve years later, in 1900, a gentleman called, who stated that he was the father-in-law of this young man; that the young gentleman was very wild and had separated from his wife whom he had married within a year of his visit to us; but that before the separation she had two children. "*Honi soit qui mal y pense!*"

Exciting Cause.—One can not but feel that the onset of tuberculosis in an organ so exposed to sexual and traumatic violence as the testicle must often be occasioned by some such agency. Indeed, it is currently believed that tuberculosis of the testicle often follows upon gonorrhœa. Yet in only 11 of my cases was the patient known to have gonorrhœa, either acute or chronic, at the time of onset; while 19 denied ever having had this disease. Six alleged that the testicle had first swollen after an injury, and, of the 4 cases with quiescent testicular tuberculosis whom I saw, through attacks of gonorrhœa, 2 had acute testicular exacerbations, and 2 did not.

I have not, by the way, seen any evidence of tuberculosis inoculation by coitus.

The effect of sexual excess upon the lesion I have no means of judging; though I have seen one case of chronic, unilateral testicular tuberculosis arise *after* the death of his wife in a man who asserted that, during ten years of married life, he had practiced sexual intercourse on an average of once in every 24 hours.

Distribution of Lesions.—The lesion in the testicle may be but an incident in a general tuberculosis. Indeed, of the 24 patients already mentioned, who had lesions in lung, bone, etc., before the genitals were attacked, 4 continued to develop lesions outside the genito-urinary tract thereafter, and were joined by 7 more; making 31 cases in which the genito-urinary tuberculosis was but a part of a more or less disseminated and consecutive invasion of different organs.

Of these subsequent lesions, 6 were in the lung—shortly (twice), four, six, six, and ten years after the invasion of the testicle); 4 were in bones, joints, or tendon-sheaths (intervals of one, two, five, and seven years); one in the meninges (6 years); one in the groin glands (3 years); one in the colon (one year); while a case of diabetes after ten years was doubtless due to pancreatic tuberculosis.

But, in contrast to these 31 cases of truly generalized tuberculosis, there are 26 cases followed at least one year, in which the active tuberculosis was confined entirely to the

testicle; and half of these were followed less than four years. Thirteen cases of isolated testicular tuberculosis persisted respectively for four (3 cases), six, seven, (2 cases), eight (2 cases), nine, ten, twelve, fourteen and twenty-five years. In these cases there was never even any grave involvement of the internal genital organs.*

Side First Affected.—In 58 cases the side first affected was noted, and of these 27 began in the right testicle, 31 in the left.

There is a general impression, which I myself have harbored, that genito-urinary tuberculosis often clings to one side of the body. I doubt whether this is as often the case as we have supposed, for the opposite testicle is often promptly affected. I find, moreover, that in the 7 cases of general genito-urinary tuberculosis in which the onset of the disease in testicle and kidney is accurately reported, 4 were primarily unilateral; that is to say, the first kidney affected was on the same side as the first testicle affected; while 3 were not.

Site of the First Inflammation.—I have never seen a case of primary tubercular orchitis. The primary focus in my cases has always been the epididymis. This is the rule, though apparent exceptions are occasionally reported. But I think there is a general impression that gonorrhoeal epididymitis usually begins in the globus minor, while tubercular epididymitis usually begins in the globus major. In only 25 cases was I able to obtain information upon this point; yet in 19 of them the first nodule appeared in the tail of the epididymis, leaving only 6 in which it began in the head. It would be dangerous, therefore, to insist on the diagnostic importance of the site of the first lesion.

Of associated lesions, besides those already mentioned, I may state that abscess of the vas is recorded 11 times; hydrocele 30 times. Yet in the cases that come to operation, we

* Thirty-five remained purely genital one year or more. Two of these were followed four years, 1 five, 1 eight, 1 nine, 1 eleven, and 1 thirteen years (besides those noted in the text as purely testicular). Fifteen (exclusive of the above mentioned) remained urogenital one year or more. Of these 2 were followed four years, 1 five, 1 seven, 2 eight, 1 ten, 1 sixteen, and 1 eighteen years.

practically always find hydrocele, or else adhesions in the tunica vaginalis, showing that it has been inflamed; and so common is tuberculosis of the vas that it is scarcely ever safe to bury the end of the divided vas without providing for drainage from it.

Recognizing how irregular tuberculosis may leap from one organ to another we can make no attempt to arrange the confused succession of lesions presented by our patients.

Theoretically we might divide them into two classes: (1) those in which the testicular lesion is the chief active tubercular lesion in the body (26 cases), and (2), those in which the tubercular lesion is only a part—perhaps a relatively unimportant part—of genito-urinary (24 cases) or general (31 cases) tuberculosis; but no patient remains hard and fast in either class. The clinical picture varies as one or another lesion rises into prominence. One may follow clinically, however, and with some degree of order the course of the lesion in the testicle itself (where it may be acute or chronic, suppurating or quiescent) and in its fellow.

Onset.—The onset was acute in 34 cases, chronic in 34. I need scarcely describe the difference between the two. The chronic lesion consists of a slightly sensitive nodule in the epididymis, while the acute epididymo-orchitis causes intense congestion and œdema, and is associated with fever and pain. In one case the process was so virulent as to simulate strangulation of the testicle; in many others it resembled acute gonorrhœal epididymitis.

This acute onset, as well as the acute exacerbations during the course of the disease are probably due to mixed infection. Caseation and fistula may, however, occur without any mixed infection.

Such breaking down, whether acute or chronic, simple or tubercular, occurred in at least 76 of the 152 testicles, probably in a great many more. It is a striking fact, however, that of these 76 cases of softening or suppuration, 53 occurred in the first year, while late suppuration was noted only once in the third, fourth and fifth year respectively.

It would seem, therefore, that if the process remains chronic in the epididymis for a year or two, it is not very likely to break down. I have seen the nodule become swollen and threatening to break down in later years; but it has always either settled back into its chronic condition or been removed before softening took place.

On the other hand, no suppuration occurred in 29 cases watched for more than one year. Fourteen of these were followed less than four years, 9 from four to nine years, and 6 respectively ten, eleven (2 cases), twelve (2 cases) and sixteen years.

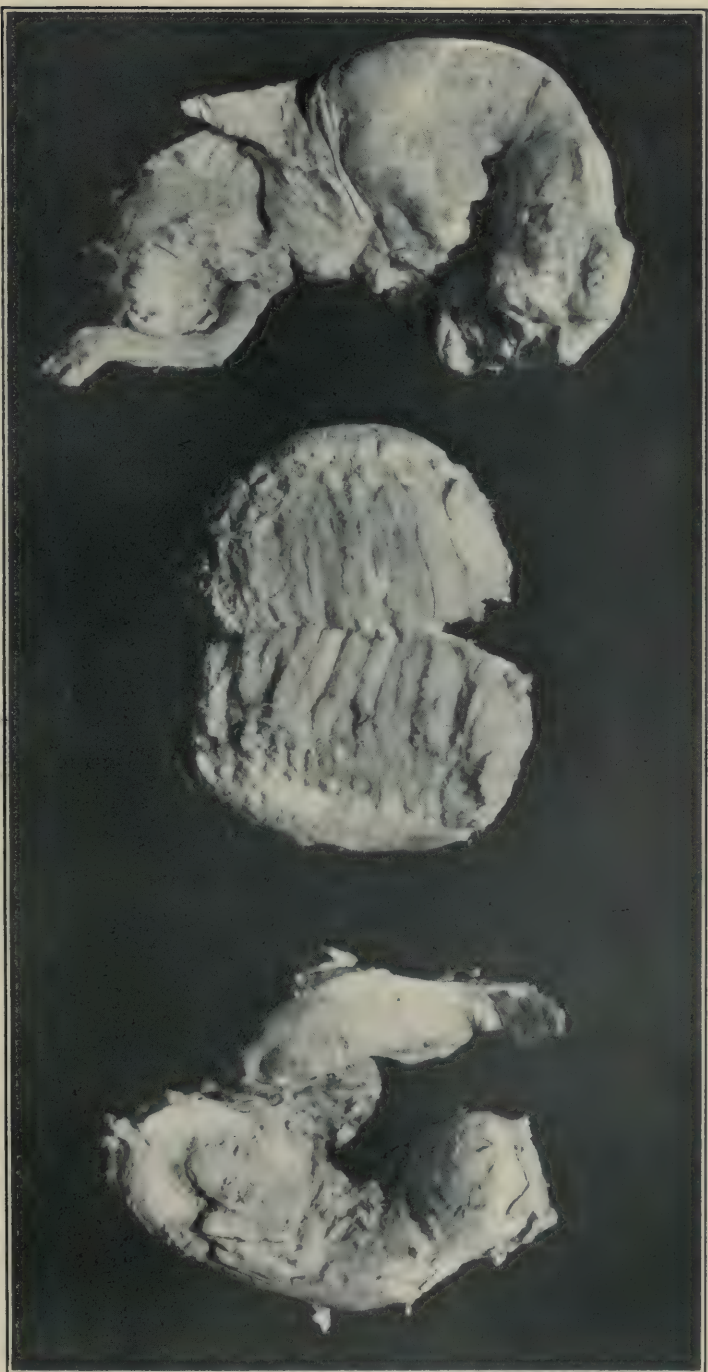
Condition of the Opposite Testicle.—Here is perhaps the most important point of all. Many patients permit one testicle to be removed in the hope that the disease is confined to this one organ, and may be amputated. That this hope is utterly vain, and that relapse upon the opposite side almost inevitably occurs—be the operation ever so slight or ever so radical—I hope to show in discussing the various operative procedures.

For the present let me summarize the 87 cases in which it is definitely recorded that the opposite testicle was or was not affected. Fifty-three so relapsed; 34 had not done so when last seen.

The following table shows the details:

	Relapse on opposite side.	
	Yes	No
Shortly	34	14
1 year	12	5
2 years	2	2
3 years	2	3
4 years	1	0
5 years	1	3
7 years	0	1
8 years	0	1
9 years	0	1
10 years	1	1
14 years	0	1
16 years	0	1
27 years	0	1
Totals	53	34

FIG. 1.



Right epididymectomy—left orchidectomy. On the right side the vas is manifestly enlarged; on the left it seems normal. The testis was removed because it was feared the blood supply had been cut off in removing the epididymis. Many small tubercles may be seen in the testis. Under ordinary circumstances, however, such a gland as this might be left in situ, with the expectation that it would heal.

FIG. 2.



Invasion of the testis by tubercles. (This specimen was taken from the gland pictured in Fig. 1.)

It is notable that, in practically every case the relapse occurred within four years, hence, if the opposite testicle escapes infection five years, it is pretty well out of danger. The 7 cases showing no infection of the opposite testicle at intervals varying from seven to twenty-seven years will doubtless remain unilateral, and they probably represent from 10 per cent. or 20 per cent. of the total number.

Subsequent Lesions Elsewhere.—Extension of the tuberculosis from the kidney to the genital organs occurred in 11 cases. In one of these the kidney was involved thirteen years before the testicle was attacked; in another seven years; in 2 cases three years, once by two years, and twice by one year. In the remaining 4 cases the kidney was known to be involved only a short while before the testicle.

The converse of the picture—extension of genital tuberculosis to the kidney—took place 9 times; one in each year from the first to the eighth, and once in the sixteenth year.

Extension beyond the genito-urinary tract occurred 11 times, as already stated; and in 4 of these there had been previous tuberculosis elsewhere. The progress in these 4 cases was as follows: 1. Ancient hip disease; testis at forty-three years; lung a few months thereafter. 2. Humerus, ancient; testis at twenty-six years; then opposite testicle; then glands in the neck at twenty-seven years; lung and kidney at thirty-one years; and died at thirty-two of tubercular meningitis. 3. Ancient Pott's disease; left testis at forty-seven; rib at forty-eight; right testis and right kidney at fifty; teno-synovitis at fifty-four; and rib at sixty-two. 4. Elbow, toes, fingers and rib at twenty-one; both testicles at twenty-two; glands in the groin at twenty-four.

No statistics can be derived from these cases; they simply illustrate the uncertainty and irregularity of tuberculosis.

*Prognosis of Cases Not Operated On.**—One would suppose that the prognosis of suppurating cases was far worse than of those that did not suppurate. Practically speaking, however,

* In some of these the first testis was operated upon: calculation is then made from the second.

this does not prove to be the case; for the pain and fever of suppuration, and the disgusting sinus that follows rupture of the abscess, lead the patient to take so much better care of himself that, on the average, such cases seem to do better than those who do not suppurate.

I have followed for more than a year 35 cases that did not suppurate and 34 that did (1 duplicate). Of the suppurating cases: 18 were still active when last seen, 2 of them within three years, 2 four, 3 five, and 1 six years. Sixteen either burst or were incised, suppurating for a certain number of months thereafter, and then were seemingly cured. Three such apparent cures were followed but one year; 1 for two years; 1 for four; 1 for five (bilateral); 1 for six; 1 for seven; 1 for eight; 2 for ten (1 bilateral); 1 for twelve (bilateral); 1 for thirteen*; 1 for twenty-five (bilateral); 1 for twenty-seven years. Yet, to prove that, no matter how long these patients remain well they are not absolutely guaranteed against relapse, in 1 case suppuration followed gonorrhœa fourteen years after the apparent healing.

That thirty per cent. of cures, watched for more than three years, should follow suppuration in the tubercular testis is most surprising, and I fear would not be verified if the cases were more numerous. Yet, on the other hand, those cases which did not suppurate were forever smouldering or advancing. Single cases showed irregular activity as late as five, six, eight and ten years after the onset; while apparent cures were observed at five, eight, nine, twelve* and sixteen years,—only 14 per cent.

The Longest Cases.—In order to clear the horizon a little, I shall briefly recite the history of the 10 cases observed for ten or more years after the onset of tuberculosis of the testicle.

I.—At thirty-six years the right testicle suppurated, and the abscess burst and healed after a certain number of months. The patient remained well ten years later.

II.—At twenty-five the right testicle was acutely inflamed

* Opposite testes of one patient.

during a gonorrhœa. It did not suppurate; the acute inflammation subsided, but left lumps in the epididymis. Five years later there was prostatic abscess, and five years after that the left testis and vesicle were acutely inflamed. The testis did not suppurate within the year during which the case was followed.

III.—At thirty-three years both testicles enlarged spontaneously, and suppurated. They then remained quiet for ten years, when he was again seen with pulmonary tuberculosis, diabetes, and a slight exacerbation, lasting only a few months, in the right testicle.

IV.—This is the case already mentioned, who had double suppurative epididymitis at twenty-one, and was said to be well and have two children twelve years later.

V.—Left gonorrhœal epididymitis at the age of twenty-one, followed by suppuration and sinus. A year later the right testicle became involved but did not suppurate, and two years after that, a prostatic focus became active. When last seen, thirteen years after the onset of his trouble, the testicles were well but the tubercular cystitis and prostatitis continued active.

VI.—Pott's disease in youth; at the age of forty-seven, the left testicle enlarged spontaneously; suppurated within two months, and was cured by epididymectomy one month later. In the following year, abscess due to necrosis of a rib was scraped, and two years after that the right testicle enlarged and was cured by epididymectomy. About this time, acute and severe suppuration in the right kidney occurred; but no operation was performed; and the patient, going for several months every year to California and various other health resorts, improved very greatly in general condition; until, at the age of fifty-four, seven years after the onset of his testicular trouble, he returned with tubercular teno-synovitis of the flexor tendons of the right wrist. This was drained and injected with iodoform emulsion for several months. During all this time he had no symptoms from his genital organs. The testicles were entirely quiescent, but the right kidney was actively suppurating, and there was probably some involvement on the opposite side. Six years later, thirteen years from the beginning of his trouble, I hear that the rib has suppurated and been incised again.

VII.—At eighteen, acute, spontaneous inflammation of the left testicle, soon followed by suppuration and fistula, and ulti-

mately healing. It remained sound for fourteen years, when it relapsed in the course of a chronic gonorrhœa (there was some suspicion of prostatic tuberculosis in this case).

VIII.—Left testicle spontaneously and chronically involved at the age of twenty-one. It so remained and, sixteen years later, tuberculosis of the left kidney developed.

IX.—At the age of twenty, the right testicle and, shortly after, the left spontaneously enlarged, suppurated, discharged and healed. When seen twenty-five years later both were lumpy and dormant; there was a nodule also in the vas on the left side.

X.—Pulmonary tuberculosis in early youth. At the age of twenty-eight, the right testicle spontaneously enlarged, suppurated, and discharged. The epididymis was quiet and nodular when he was seen twenty-seven years later.

These case reports are little less than shocking in their optimism: and, were there but one or two of them, I should gladly put them down to mistaken diagnosis. For it seems incredible that so large a proportion as 10 per cent. of the cases on our books should have lived at least ten years from the involvement of the testicle; and still more incredible that, of these 10, no less than 4 were, seemingly, absolutely well of all tuberculosis—and this without any operation.* Such statistics make one very hopeful about tuberculosis of the testicle, though they by no means remove the uncertainty of prognosis in any given case. Yet I can positively assert that some of my most promising cases now are those who at one time looked absolutely hopeless.

One patient, for instance, summoned me after having lost one testis by "guaranteed" amputation, and with its fellow in a sea of pus. His physician told the family he could not live three months; but I drained his abscess and sent him to Liberty. A year later he returned healed, but with much albumin and many casts persisting in the urine. He took part in one of our most dramatic fires of recent years; spent two years in Western Pennsylvania; returned to New York; got himself insured in the New York Life; and is now recovering from his first clap. His tuberculosis remains quiescent.

* Except Case VI.

Mortality.—I can record no mortality from tubercular testicle. One patient died of phthisis (six months), one of tubercular meningitis (six years), and one of pelvic abscess after operation (six years); but none of these deaths is directly attributable to the testicle.

Diagnosis.—The three conditions with which the tubercular testicle is likely to be confused are simple epididymitis, syphilis, and neoplasm. The means for distinguishing these three conditions are the following:

1. Aspiration of hydrocele or drainage of abscess in order that the lesions of testicle and epididymis may be accurately palpated.

2. Familiarity with the clinical aspect of tuberculosis of the testicle,—the little, rounded nodules; the diffuse infiltration of the epididymis; the acute epididymo-orchitis; the frequency of hydrocele and abscess; the ever-present sensitiveness to pressure.

3. Tubercular family history, upon which too much weight must not be placed, and tubercular personal history, which is often an important aid in diagnosis.

4. Evidences of tuberculosis in the internal genital organs, as evinced by active tubercular lesions, chronic tubercular nodules, or a slight haze in the urine and some pus in the prostate (which may be expressed by massage).

5. The diagnosis can be absolutely clinched by discovery of the tubercle bacillus in the urine, in the pus massaged from prostate, or in the contents of hydrocele fluid or abscess.

6. Still further confirmation may be obtained by operation..

Yet that these signs may all fail I am sure from several cases in which the careful and close observation of months failed to distinguish absolutely between tuberculosis and other lesions.

I will cite only 3 cases, in 1 of which simple inflammation simulated tuberculosis; in another of which I advised the removal of a syphilitic testicle; and, in the last of which a neoplasm of the testicle itself was very misleading.

I.—(Observed by Dr. Keyes, Sr.).—The patient is thirty-nine years of age. He complains that, three months ago, having a little uneasiness in the perineum, he consulted a physician, who passed a sound and a searcher.

After this there was for the first time a slight urethral discharge; for the cure of which the physician injected nitrate of silver into the deep urethra. After six days of this treatment the patient took to his bed with acute cystitis and left epididymitis. He was in bed for three weeks, and then the testicle suppurated. When first seen by Dr. Keyes there was an abscess at the tail of the epididymis which he opened. The urine was acid, purulent, and dense, and contained spermatozoa and albumin. Urination urgent, once at night and six times by day, and accompanied by terminal spasm. The patient had lost 18 pounds.

He was at first put upon internal medication, and then treated by instillations of thallin and sulphate of copper. He was much improved in a month, and left town, to return again in two years with a little pus in the urine but the testicle entirely well.

Two years later—in 1895—the urine is absolutely normal and sparkling, and palpation of the internal and external genitals reveals absolutely nothing.

This is one type of pseudo-tubercular, simple epididymitis. In another type, the epididymis remains lumpy for a long time after the first involvement and, occasionally, flares up. Rest, tonics, stopping urethral treatment, elevation of the testicle, and application of ichthyol plaster to it relieve this condition and establish the diagnosis.

II.—February 18, 1905. Patient is thirty-four years of age. Gives no previous venereal history, except a doubtful story of a sore on the frenum in June, 1903, which lasted but a week. He immediately began mercurial treatment and has continued it ever since. There has been some vague eruption on the genitals, some fleeting mouth lesions. A letter to the physician who treated him evokes a non-committal reply.

His present complaint is a nodule about one centimetre in diameter, with little irregularities in its surface; but generally rounded, embedded in the top of the right epididymis and encroaching a little upon the testicle. The lump is insensitive

FIG. 3.



Carcinoma of testicle, resembling tuberculosis. (Case of Dr. G. D. Stewart.)

and was discovered by accident. Vesicles both moderately distended; right half of prostate thicker than the left, but not lumpy; urine entirely normal.

He states that the lump appeared a year ago and was quite painful for a little while, since which it has been entirely painless and has rather diminished in size. He is engaged to be married.

He was instructed to stop his mercury and not to marry; to apply 10 per cent. guaiacol to the testicle; and to take 10 minims of creosotal in emulsion three or four times a day. After six weeks of this treatment the lump distinctly diminished, and I did not see him again until September 20, 1905; when he returned married and with round lumps of all sizes throughout the testis and epididymis, with adhesions within the vaginalis which could be felt to creak, but with no change either in his general health or in the normal condition of the urine, prostate, the vesicles, or the other testicle. The diagnosis of tuberculosis was, accordingly, made; the testicle was removed at Washington, and proved to be syphilitic.

I was misled in this case by the typical, rounded lumps, by the onset in the epididymis, and by the early tenderness. But its absolute insensitiveness under my fingers, and the absence of any sign of tuberculosis of the internal genitals, should have warned me that it was not tuberculosis.

III.—The third case was that of a physician thirty-odd years of age, a patient of Dr. Geo. D. Stewart. He stated that, for many years, he had had slight enlargement of the left testicle. There was a little hydrocele and the entire testis and epididymis seemed full of elastic nodules; no lesions were discovered elsewhere in the body. He was put on a trial course of mixed treatment, but frankly advised that the condition looked like neoplasm.

The treatment did no good. He consulted a number of other physicians, all of whom made a diagnosis of tuberculosis; but, as the lesion was beginning to be active, he submitted to operation, and the organ (Fig. 3) was removed by Dr. Stewart at St. Vincent's Hospital. Pathological examination revealed carcinoma.

Hygienic Treatment.—The hygienic treatment of tuberculosis is as efficient in tubercular testis as in phthisis. It is the foundation of every cure. I will make only two remarks concerning it.

1. It must be aided by intelligent surgical treatment.
2. Many patients do surprisingly well in and about New York without change of climate.

I am doubly surprised at the good results of my cases considering how unfaithful they have been to many of the fundamental rules of hygiene.

The most remarkable patient I ever saw was a dentist, twenty-one years of age, with very acute tuberculosis of the left testis. I cured his hydrocele by carbolic injection at the onset of the disease and, thereafter, he took heavy doses of creosote for eighteen months; but has, in the nine years since that time, hardly left his work a day. He is pale as a hospital interne; he works ten hours a day; he overdoes himself sexually; he went through an attack of gonorrhœa last summer; yet his testis got well in three years and has so remained.

SURGICAL TREATMENT.—Let us first discuss the treatment of hydrocele and of abscess, for on these we can all agree.

Hydrocele.—Small hydroceles need not be disturbed. They usually disappear with the subsidence of the acute process. Large ones may be tapped by way of palliation or may form an excuse for radical operation.

I was surprised, in the case just cited, to see a hydrocele containing 12 ounces and overlying an active tubercular testis almost as big as my fist, refill after two tappings, and yet disappear promptly and permanently after injection of pure carbolic acid. I was still more surprised to see the testicle shrink from that time on, though up to then it had been growing quite rapidly.

My father and Dr. Chetwood have each had a similar success with carbolic injection, though without any obvious effect upon the testis. I should, therefore, suggest injection of carbolic acid into the tunica vaginalis as a possible cure for certain cases of tubercular hydrocele. It will not harm the testis; in certain hyperacute cases it may benefit it.

Abscess and Fistula.—Abscesses must be incised and drained; fistulæ kept freely open. They may be irrigated with

peroxid of hydrogen and injected with iodoform emulsion. But, if the patient must choose between local treatment in the city and hygiene in the country, let him, without hesitation, desert the surgeon and lean upon Nature.

Unless the testis is riddled with abscesses, I consider it wise not to remove it while acute suppuration is going on. Incise, drain, wait for the acute inflammation to subside, and, in a surprisingly large proportion of cases, the whole tubercular mass will shed spontaneously, and you will find that Nature has cured the lesion. On the other hand, if things progress ill, you may, at any time, attempt a radical operation.

Choice of Radical Operation.—These remarks are practical, and, inasmuch as I have never employed ligation of the spermatic cord or extirpation of the seminal vesicles or certain other procedures advised for the cure of tuberculosis of the testicle, I shall not discuss them.

The three methods I have employed, or seen employed, are erosion of the active focus, epididymectomy, and castration. Each procedure has its eminent advocates, and, actually, I have seen so few of any of these operations, that it might be more prudent to withhold my views. But my feelings upon the subject are so intense that they will not be repressed.

The results of operations are the following:

Erosion.—1 bilateral, not followed; 1 single, unrelieved; and 1 single relapsed in six months. Such results are unmitigatedly bad.

Orchidectomy.—The testis and more or less of the vas was removed from 13 patients: from 2 of them the opposite testicle was subsequently removed. Inasmuch as orchidectomy is usually done on the plea that the disease is localized in the testis and may be extirpated with it, 10 of these operations* were done upon patients who, at the time, had but one swollen testicle; while the other 5 were called for by the total destruction of the testis by suppuration or caseation.

Of the 10 patients in whom but one testicle was involved at the time of operation, 3 relapsed on the opposite side within

* None of them performed in our office.

one year; 2 after one year; and 2 more after two years, making 7 relapses in all; while of the remaining 3 in whom the opposite testis was not known to be involved, 2 were followed less than a year, and 1 was followed two years.

Further evidence of the futility of attempting amputation of the tuberculosis is the involvement of other organs within two years of unilateral orchidectomy. One case of urethral abscess, 1 of vesicular abscess, 2 of tubercular kidney, 1 of acute prostatitis, and 1 of tubercular inguinal adenitis.

Such results simply confirm the belief that, whether apparently localized in the testicle or elsewhere in the body, tuberculosis is always a disseminated infection which can not be amputated.

Contemplate for a moment the plight of a patient who has gaily sacrificed one testicle upon the assurance of thereby saving its fellow. The relapse upon the opposite side plunges him into intense and black despair. This reason alone impels me to prefer some more conservative operation.

Epididymectomy.—I have record of 13 epididymectomies upon 8 patients.* One single operation was followed by supuration, prompt relapse in the opposite epididymis and removal of the testis first involved. Its fellow has remained chronic and quiescent three years.

Of the double epididymectomies, 2 were consecutive after relapses respectively in three months and in three years. One double partial epididymectomy—complete excision of quiescent nodules in the tail of both epididymes. Two epididymectomies on one side and orchidectomy on the other, the testicle being removed because it seemed impossible to save it. Two double, simultaneous epididymectomies.

Of these 7 patients, 1 died from pelvic abscess arising from the end of the vas deferens that had been torn off high up inside the pelvis. The others all recovered from the operation and, though one of them has still a slight fistula, three years after operation on one side (the fellow is healed), the other 6 are entirely well as to their testicles, and the cures

*Operations by Keyes Sr., Chetwood, and Keyes Jr.

have been followed for one year (3 cases), three years, and thirteen years.

These results are sufficiently good to justify continued adherence to this operation. Yet some little skill is required in doing it. The death from pelvic suppuration has warned me of the danger of tearing the vas out of the pelvis: it should be cut off at the upper end of the incision and left protruding from the skin, in order that any suppuration from it may be freely discharged.

The easiest route to the epididymis is through the tunica vaginalis. In shelling it out, one should stick close to it, in order to spare the blood supply of the testicle; and, in order to save the testicle, I believe it perfectly justifiable to cut through and leave behind manifestly tubercular tissue.

One of the arguments of those who condemn epididymectomy is that it always leaves some tuberculosis in the testis. I do not doubt the truth of this statement. Indeed, I have deliberately left a testicle full of tubercles in 2 of these cases and seen it subside and give no further trouble. Some of the results have been peculiarly brilliant. Two of them scarcely show the least departure from a normal appearance, the scar of the epididymectomy having quite accurately reproduced the form of the epididymis itself.

My choice of operation is, therefore, always epididymectomy, unless the testicle is too far gone to be saved: and I am willing for the moral effect upon the patient, to risk leaving an infiltrated testicle, believing that it can fight down the inflammation after the removal of its inflamed epididymis.

Time for Operation.—I began to treat these cases ten years ago under extremely conservative influences. My father's rule has been never to touch the epididymis until it threatens suppuration; then to excise it; or to drain first and excise later. Yet, in view of the grave frequency of relapse in the opposite epididymis, the apparent frequency of sterility at the time the first epididymis is involved, and the excellent effect upon the general health and upon tuberculosis of the prostate and vesicles, which I have several times seen result

from the removal of an apparently quiescent, chronic, tubercular epididymis, I am inclined at present to advise the following procedure:

If a patient appears with acute tubercular, epididymo-orchitis, treat him expectantly until the lesion suppurates or becomes subacute. If it suppurates, drain, or, in exceptional instances, remove the whole testis. When it settles down into chronic epididymitis, or if it begins as such, examine the spermatic fluid; and, if this, on several successive examinations, shows no spermatozoa, excise both the tubercular epididymis and its unaffected fellow. For this will do no harm and will prevent relapse upon the opposite side. Moreover, it will have a doubly soothing effect upon the prostatic or vesicular tuberculosis; for removal of the epididymis produces, in a less degree, the beneficial effect upon tuberculosis of the internal genitals that nephrectomy has upon tuberculosis of the ureter. If spermatozoa are found in the semen, the normal testis of course may not be touched.

This early prophylactic operation should reduce the importance of testicular tuberculosis to almost nil, and should prevent many of those tubercular outbreaks in other organs which seem to be fed from active or latent foci of the disease in the epididymis. But I foresee that few patients will submit to it.

CONCLUSIONS.

1. Testicular tuberculosis is clinically never an isolated lesion. It is only one feature of a general genital tuberculosis, for
2. Sterility is frequent if not constant, at the time the first testis is invaded.
3. There is evidence at this time of inflammation of the internal genitals.
4. Relapses in the opposite testicle occurs within a few years, in eight or nine out of ten cases, and
5. Such relapse is in no wise postponed by early removal of the diseased testis.

6. Moreover, though suppuration seems often to result in permanent cure of the local process, and

7. Though a chronic focus several years old is likely never to suppurate, yet

8. In no case can one feel certain of a real cure unless the tubercular epididymitis has been removed. Now

9. The demoralizing effect of epididymectomy is not to be compared with that of castration, and

10. Slight tuberculosis of the testis may be depended upon to heal spontaneously after removal of the epididymis.

11. Hence epididymectomy is the radical operation of choice, unless there is hyperacute generalized epididymo-orchitis, or unless the testis is destroyed by suppuration.

12. This operation has a beneficial effect upon the general health and upon tuberculosis of the internal genitals.

13. It should, therefore, be performed early in the disease. This in spite of the fact that

14. Tuberculosis of the testis is often but an insignificant part of a generalized progressive tuberculosis, or

15. Is for many years the only active lesion of the disease.

16. If the patient is sterile, it would probably be wise to remove both epididymes, even though only one side is diseased.

I. FRACTURE OF THE GREATER TUBEROSITY OF THE HUMERUS, WITH DISLOCATION OF THE HUMERUS INTO THE AXILLA. IMMEDIATE REDUCTION OF DISLOCATION. ON SEVENTH DAY NAILING OF FRAGMENT OF TUBEROSITY IN PLACE.*

II. FRACTURE AT THE ANATOMICAL NECK OF THE HUMERUS AND DISLOCATION OF THE HEAD INTO THE AXILLA, WITH FRACTURE OF THE SHAFT. DIFFICULT REMOVAL OF HEAD OF HUMERUS.*

BY WILLIAM WILLIAMS KEEN, M.D.,

OF PHILADELPHIA.

Professor of Surgery, Jefferson Medical College.

I.

E. F. K., æt. fifty-nine, first consulted me January 29, 1907. Three days before, on January 26, in getting off a trolley car on the ice-covered street, he slipped and fell, striking his left shoulder,—he rather thinks upon the point of the shoulder, though he is not certain of this. He also thinks that when he found himself about to fall he threw up both arms violently in the air, as would be very natural, but he is also not quite sure of this.

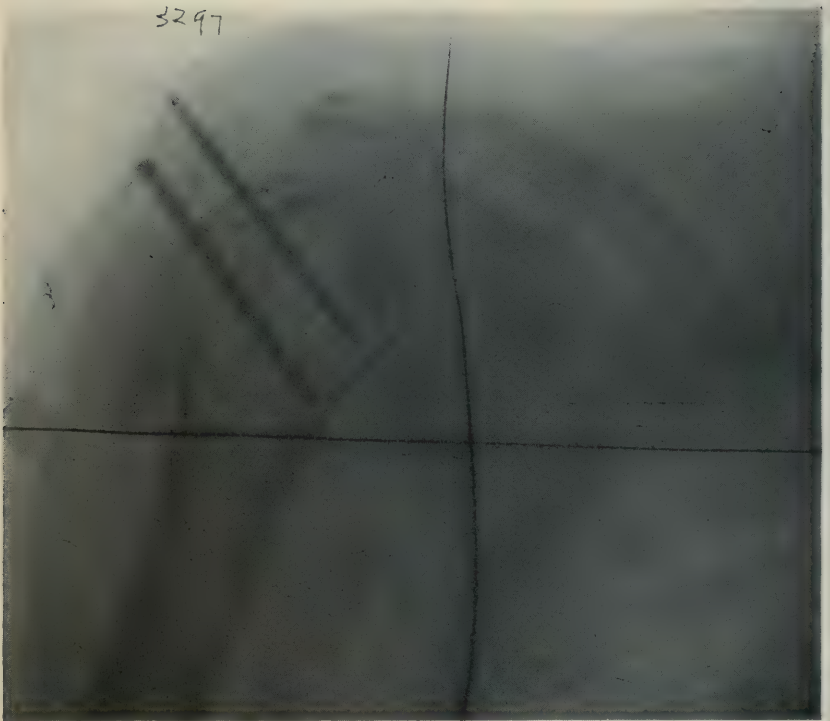
The moment the accident occurred he felt great pain about the head of the humerus, and the whole arm was useless; he was scarcely able even to move his fingers. He was taken to the Pennsylvania Hospital. Here he was attended by Dr. William Drayton of the resident staff, and I owe to him and to Dr. Montgomery, the skiagrapher, the early history of the case and the skiagraph. A dislocation into the axilla was diagnosed and was reduced under ether. No crepitus was felt until after reduction of the dislocation. An X-ray picture was then taken, which showed a fracture of the greater tuberosity (Fig. 1). The arm felt much better after the dislocation was reduced. No bruise existed about the shoulder to show the point of impact when he fell. When he came out of the ether, the arm was so bandaged to his body that he was unable to move it in any direc-

* Read before the Philadelphia Academy of Surgery, March 4, 1907.

FIG. 1.



FIG. 2.



tion and hence whatever disability may have resulted from the fracture of the greater tuberosity cannot be definitely stated, as no opportunity for muscular movement had existed. He left the hospital the same day.

When he saw me, three days after the accident, I found the arm securely bandaged with a shoulder-cap splint and he was very comfortable. Examination of the excellent X-ray picture showed that the greater tuberosity was broken off in a triangular fragment, the base being uppermost and the apex extending about to the surgical neck. The fragment was drawn upward and backward so that it lay between the spine of the scapula and the head of the humerus. Evidently, if it remained there, it would be a serious bar to abduction of the arm to or beyond the horizontal, and probably also to other movements, and external rotation of the arm would be impaired or lost. I, therefore, took him to the Jefferson Hospital and had Dr. George W. Spencer and Dr. W. F. Manges try different positions of the arm, to see if any of them approximated the humerus to the fragment in such a way as to restore their proper relation, for it was clear that the fragment could neither be brought to its normal position by manipulation nor held there by any suitable dressing.

Several attempts were made to effect this purpose by elevation of the arm and external rotation with retention of the arm in place by plaster dressing and in other positions, but all were failures. I, therefore, determined to operate by exposing the parts, drawing the fragment of the tuberosity into place and holding it there by wire nails. Though at that time I knew of no case thus operated upon, it seemed to me both rational and reasonable to do so.

Operation, February 2, 1907.—I made a vertical incision a little in front of the middle of the acromion directly down through deltoid to the bone, separating the fibres of the deltoid as far as possible rather than cutting them. As soon as I reached the bone, I detected the anterior edge of the bony fragment lying at the posterior margin of the wound. Carrying my examining finger under the anterior edge of the wound, I found the rough, raw surface from which the tuberosity had been torn away at a considerable distance from the anterior margin of the wound. The fragment torn away from the humerus was separated from it by about 5 to 6 cm., and lay posteriorly between the head of the

bone and the acromion and spine of the scapula. Evidently no union other than perhaps a very poor fibrous union could ever take place between the normal surface of the bone and the capsular ligament and the raw surface of the fragment. Moreover, the position of the fragment would interfere with the usefulness of the arm, for whenever the arm was raised, this ectopic piece of bone would be a sort of wedge between the acromion and spine and the head of the humerus. An assistant, therefore, rotated the humerus externally as far as possible. This brought the posterior edge of the raw surface of the bone to the anterior edge of my incision. I was able then to expose this raw surface by strongly retracting the anterior edge and next to draw forward and downward the fragment of bone so that I brought it nearly into its normal position. It was impossible to get it absolutely into its former place. I found the best means to replace the torn fragment of bone was by seizing the tissues around it with the Allis "tissue forceps." These practically resemble the one-prong tongue forceps, the opposite blade being a simple curved notch rather than the broad surface of the tongue forceps.

Holding the fragment in position, I drilled two holes in it and nailed the fragment in place by means of two wire nails 7.5 cm. in length and about 2 mm. in diameter. These were long enough to allow the head of the nail to protrude beyond the skin. A large portion of the nail, of course, was outside the bone, corresponding to the thickness of the deltoid, the fat and the skin (Fig. 2).

The wound was then entirely closed, excepting where the nails protruded, and at the lower angle where I inserted a small bit of gauze for a temporary drain, especially because there was considerable grumous blood accumulated at site of fracture.

His highest temperature was 100° degrees, and he made a perfectly uneventful recovery. One nail was removed without difficulty at the end of two weeks and the other at the end of the third week. The wound left by the nails healed quickly. Passive motion and massage were begun at the end of four weeks.

REMARKS.

Until very recently fracture of the tuberculum majus of the humerus has been believed to be very rare. In the statistics of Gurlt, covering one hundred years, he records but 46

examples found in literature and in museums. Usually the fracture accompanies dislocation. Gurlt found only 4 cases of fracture unaccompanied with dislocation, and even one of these was not free from doubt.

The systematic use of the X-rays, however, has entirely disproved this notion and has shown that, on the contrary, it is a not uncommon fracture. I have asked several skiagraphers in Philadelphia as to their experience, with the following results:

Dr. Manges of the Jefferson Hospital has only had one case; Dr. Kassabian has seen 4 in about 800 fractures; Dr. Leonard has no exact record, but recalls 2 of the great tuberosity alone, and at least 6 cases with other associated fractures; Dr. Pfahler of the Medico-Chirurgical Hospital in 84 cases found 7 such fractures with no other lesion, and 3 cases of this fracture associated with dislocation; Dr. Frederic Montgomery of the Pennsylvania Hospital, in 75 cases of injury of the upper end of the humerus has found 3 cases of this fracture including the present case; Dr. Pancoast, at the Hospital of the University of Pennsylvania, writes as follows: "In looking over the skiagraphs I have made of fractures of the upper part of the humerus, I found 6 cases of fracture of the great tuberosity, which seem to belong in a class by themselves. In one of them there is also an incomplete fracture of the surgical neck, and in another, either an incomplete or an impacted fracture of the surgical neck. In this last case, no fracture whatever was diagnosed clinically. The other 4 cases were purely uncomplicated. In addition to these cases, I found 3 with fracture of the anatomical neck and the tuberosity, and 4 with fracture of the surgical neck and the tuberosity. In all these 7 cases, as in the first 5, the tuberosity is a separate fragment by itself.

"The fragment representing the tuberosity varied in size from a thin scale of bone to the entire tuberosity and part of the neck below it.

"In 1 case only, out of the 12, am I certain that a clinical diagnosis of fracture of the tuberosity was made prior to the

skiagraphic examination, but such a diagnosis could hardly have been expected in the seven distinctly complicated cases."

These six observers have, therefore, seen at least 21 uncomplicated cases and 18 more with other associated lesions, all, presumably, within about four or five years. Through their courtesy, I was able to show 23 of these 39 skiagraphs.

Before the X-rays were used, the lesion was generally diagnosticated as a severe "contusion" or "bruise" of the shoulder, which often permanently disabled the arm to a greater or less extent. Now we know that the condition is more frequent and the consequences much more serious than has been believed.

FIG. 3.

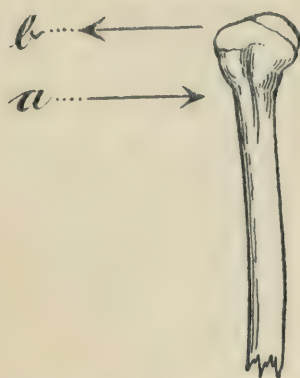


Diagram to show the opposite direction of the two forces acting on the head of the right humerus. *a*, direction in which the bone is forced in the dislocation; *b*, direction in which the muscles act either in suddenly throwing up the arms to prevent the fall or in the involuntary endeavor to prevent the dislocation.

Whether the cause is always the direct result of a fall or blow on the shoulder, or whether it may result from muscular contraction alone, is disputed. Doubtless both of them act together, the dislocation acting in one direction (inward) and the sudden contraction of the muscles in the opposite direction (outward) (Fig. 3). In the present case the blow dislocated the humerus, but the sudden and violent elevation of the arms to prevent his fall might well have produced the fracture in a man of fifty-nine, even if there had been no fall.

The pathology of the lesion has been well ascertained by the findings at operation and by the extraordinary good fortune of Jössel, who in 1880 reported the facts ascertained by the dissection of 9 cases of habitual dislocation of the shoulder. He found the supra- and infra-spinati torn loose, retracted and in fatty degeneration, part of the capsule was torn loose and the head of the humerus was in contact with the deltoid and the acromion. Of 8 cases of old dislocation operated on by Kocher, in 6 the tuberculum majus was torn off. Last year Perthes reported 10 cases of luxation of the shoulder, in 6 of which there was either a fracture of the tuberosity or the muscles were torn loose from the bone.

The results of such a fracture are a displacement of the fractured fragment usually backward and upward between the head of the humerus and the acromion or the outer end of the spine of the scapula. In this position, union of the fragment is often improbable and sometimes impossible. The fragment, if of any size, is an obstacle to upward movement of the arm. The loss of attachment of the supra- and infra-spinati and the teres minor involves diminution or loss of external rotation of the arm, and, as Perthes especially has shown, permits repeated and finally habitual dislocation of the head of the humerus. In fact, in his opinion this is the principal reason why habitual dislocation occurs.

Formerly the diagnosis was in most cases only presumptive until the advent of the X-rays. In fat persons especially it was often impossible to make a diagnosis if this fracture was associated with other fractures or with dislocation. The contour of the shoulder, in a minor degree, however, resembles a dislocation, as shown by the prominence of the acromion and a furrow below this prominence. The head of the bone may be broader than normal; if the fractured fragment is of any size, a groove can sometimes be felt between it and the head of the bone; crepitus may be felt but sometimes is absent, especially while the dislocation is unreduced, as in the present case, and it will usually be impossible to lift the arm above the horizontal—even passively—and external rotation is lost or les-

sened. The deltoid is sometimes atrophied as a result of injury to the circumflex nerve.

As long ago as 1886, Bardenhauer suggested suture as a means of treatment; but it seems not to have been done till 1898 by W. Müller. The latter surgeon excised an oval portion of the capsule of the joint and sutured the muscular attachment by advancement (*Vornähung*) of the external rotators. In 1904 Perthes operated on 2 cases by means of double-pointed, U-shaped nails. Both of his cases were ancient fractures, one being operated on over three years and the other five years after the accident. He made the posterior incision of Kocher for excision of head of the humerus, in one case chiselling a part of the spine and the acromion (which were wired later), and turning downward and forward a large deltoid flap. In both the results were good.

My own case is, I believe, the first in which a primary operation has been done. I made a vertical incision, seized and drew downward and forward the fractured piece, and, after external rotation of the arm, nailed the fragment as nearly as possible in place by two disinfected wire nails which were afterwards removed.

I should have delayed publishing the case until I could report the final result, but that a long absence in the immediate future prevents my waiting. Every indication points to a speedy and satisfactory result, as there is little ankylosis of the joint. Passive motion has just been begun.

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II.

CASPER K., æt. sixty, first consulted me December 23, 1905, with Dr. A. P. Hull of Montgomery, Pa., to whom I owe the following history:

On November 18, 1905, he fell from the top of a wagon of fodder about 10 feet, falling on his feet. The fodder followed, fell upon him and threw him forward. He fell, striking on his right shoulder. He was helped up and walked to his brother's house about 100 feet away.

Dr. Hull saw him two hours later and found a subcoracoid dislocation. Under chloroform this was reduced and the forearm put in a sling. At the end of three weeks, as he had not called as directed, the doctor went to see him and found that the dislocation had been reproduced; he also discovered crepitus on moving the arm. The patient states that he has had pain ever since the accident. He has slept poorly, though occasionally he has had a good night. He has had to lie with extra pillows propping him up most of the time since the accident. His appetite is fair, bowels in fair condition. He has worn a sling most of the time.

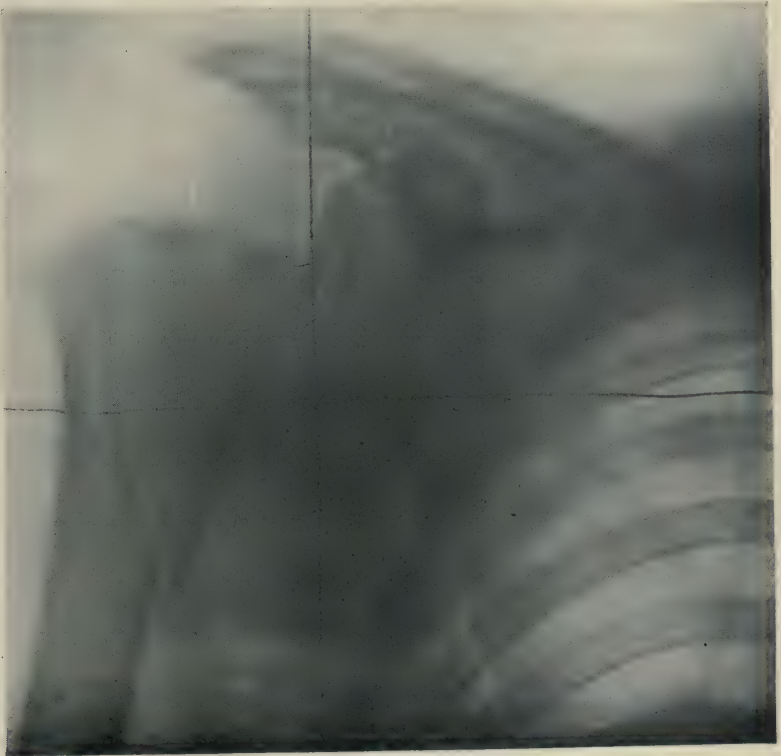
On examination I saw clearly a marked fulness under the coracoid, like a subcoracoid dislocation, but there was no outstanding elbow, nor any change in the axis of the upper arm in relation to the body. The acromion was very prominent; a hollow existed below it; there was flatness over the muscles of the shoulder posteriorly and fulness in front under the coracoid. On attempting to rotate the arm, crepitus was easily elicited, but as movement was very painful, I decided to wait till I could get an X-ray picture of the arm. The arm was greatly swollen, especially over the forearm, there being less and less swelling from the elbow up toward the shoulder. The entire arm from shoulder to elbow was also still very much discolored from the effused blood.

December 26.—On examining the X-ray picture (Fig. 4) I found that there was a fracture exactly through the anatomical neck and that this fragment was dislocated inward under the coracoid process. In addition to this there was a vertical fracture from the upper end of the shaft downward to the surgical neck.

Operation, December 27.—I first made an incision from the coracoid process down nearly to the insertion of the deltoid. I

separated the fibres of the deltoid, watching carefully for the circumflex nerve and the long tendon of the biceps. I did not at any time see the circumflex nerve. The tendon of the biceps was dislocated inward from its groove and the capsule of the shoulder joint opened. On inserting the finger, I found that the upper end of the humerus was almost entirely smooth and it was, of course, utterly hopeless to obtain union even if I had succeeded in replacing the dislocated head of the humerus or if it had any reliable blood supply. A considerable amount of fluid, black blood, evidently effused at the time of the accident, was liberated from the tissues. On dissecting toward the inner side, so as to lay bare the dislocated head of the humerus, I found it lying so much to the inside of my incision that it was evidently much more accessible by a separate incision. This started from just below the insertion of the tendon of the great pectoral in a direct line toward the sterno-clavicular articulation, reaching to a point below the middle of the clavicle. I separated the fibres of the great pectoral by blunt dissection and finally found the head of the bone with its fractured surface looking toward the middle line and the articular surface toward the humerus,—*i.e.*, completely rotated. It was very adherent, but gradually I was able to loosen it and finally to pry it up very slowly and carefully, lest I should either do harm to the nerves or to the axillary vessels which lay immediately in contact with it. By combined prying upward and traction by means of a large sequester forceps, I finally dislodged the head entirely (Fig. 5). Very deep in the wound a vessel immediately began to bleed very copiously: I was able, fortunately, instantly to put a finger of the left hand upon it and arrest the hæmorrhage. It was so deep, however, that it was impossible to ligate it through the existing incision. Accordingly, I divided completely the great pectoral tendon about 3 cm. from the humerus. This gave me wide access to the axilla and I was able finally to seize the bleeding vessel, which would have been otherwise inaccessible. The vessel was double ligated as it was bleeding from both directions. A few other small vessels required ligation. The parts were then irrigated with salt solution and the tendon of the great pectoral overlapped and sutured with twenty-day chromicized catgut. The long head of the biceps was replaced and sutured in place with catgut. A drain was placed in each wound, that in the second

FIG. 4



Fracture-dislocation of shoulder. Fracture of anatomical neck and shaft of humerus.
Dislocation of head into axilla.

FIG. 5.



Fracture of anatomical neck of humerus (Keen).

incision going deeply into the axilla, and the wounds were closed. The arm was placed next the chest, the forearm flexed in front of the chest with a pad in the axilla and a Velpeau bandage applied.

On the evening of the day of operation his temperature rose to 101 degrees, but by the second day it was down to the normal and so remained. He went home on January 7, eleven days after the operation.

Dr. Hull writes me, February 1, 1907: "He can raise his arm to two-thirds of the normal height; the wasting of the muscles of the shoulder is disappearing with use and he can use the arm right well in digging, etc."

Fracture of the anatomical neck of the humerus is an extremely rare injury. Stimson¹ states that the only reported specimens of fresh fracture without dislocation or additional fracture through the tuberosities are those of Boyer and Spence. The cases of fractures associated with dislocation are more numerous, yet even they are so rare that Stimson himself "had seen only one case in which the diagnosis seemed probable," and a second undoubted case. Hamilton² also in his very large experience in fractures saw only one case. The present is the only case that I have ever seen.

This fracture may be either intra- or extra-capsular. "It is probable, since bony union is not denied to this fracture (*i.e.*, intra-capsular fracture), that the line of separation is not always, or generally, perhaps, completely within the insertion of the ligament, but that it is in some degree extra-articular if not extra-capsular. If it is entirely intra-articular, no doubt union of the fragments can never take place and necrosis with suppuration must ensue, demanding, at a period not very remote, an operation for the removal of the fragments, the same as in compound fractures. Gibson, however, thinks that the fragment occasionally remains, being gradually absorbed and changed in figure."³

In this particular case the specimen I think shows that the fracture was wholly intra-articular. In addition to this the head of the bone was not only not displaced within the cap-

sular ligament, but was thrust wholly outside of it, far into the axilla. Impaction of the upper fragment into the lower is not uncommon, as in fact would be natural from the force necessary to break off such a limited rounded fragment. If there is impaction, union, of course, may take place.

The last edition of Stimson's work was published only a few years after the X-rays were discovered and before their general use. Hence he makes no reference to their use in such cases. These rays have made perfectly possible correct diagnoses of fractures about the shoulder joint, such as the present case and the other one that I report this evening, a fracture of the greater tuberosity. Before the discovery of Röntgen, such cases were always obscure. In Stimson's next edition, without doubt, certainty will take the place of presumption in the diagnosis.

In the present case fracture of the anatomical neck was associated with dislocation and complete rotation of the fragment and also with a longitudinal fracture of a sharp fragment from the inner side of the shaft as far down as the surgical neck. When the head is in place, crepitus can often be elicited. Had the lesion been limited to fracture and dislocation of the head, no crepitus would have been felt. Undoubtedly, the crepitus felt at the time of my examination, almost six weeks after the injury occurred, was between the fragment fractured from the shaft of the bone and the shaft itself, for the skiagraph shows that the fractured and dislocated head could not have produced the crepitus. That this second fractured fragment should not have been united with the bone at so distant a time and yet, as the later history shows, never have undergone necrosis or caused any trouble is both surprising and gratifying. Union, of course, took place later.

The acromion is usually much more pronounced than normal, but it is not so prominent, nor is the furrow under it so well marked as in a subcoracoid dislocation. The skiagraph shows well the very great distance between the upper end of the shaft and the acromion, although, as will be observed, the shaft is evidently pulled upward (to the mid-point of the

glenoid cavity) by the action of the muscles and the arm is shortened by so much. Unfortunately, I did not make any measurements of the comparative length of the two arms.

When it is not dislocated the fractured head of the bone can usually be felt within the capsular ligament and its abnormal mobility determined. When it is dislocated into the axilla, as in my own case, it can also be felt as a marked abnormal prominence either directly below, or below and external to the coracoid. If the head is not displaced outside of the capsule, it is usually displaced with reference to the shaft of the bone, so that the upper end of the bone is considerably broadened.

After all, the Röntgen rays serve the best purpose and I think are an absolutely reliable means of diagnosis. It is precisely in these obscure lesions that the X-rays help us the most.

The usefulness of the patient's arm at the present time is quite as much as one ought to expect from so serious and complicated a case and especially one that had been neglected by the patient for so long.

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PARTIAL GASTRECTOMY.*

WITH REPORT OF TWO CASES.

BY CHARLES H. FRAZIER, M.D.,
OF PHILADELPHIA.

FOLLOWING close on the heels of the agitation in favor of the surgical treatment of appendicitis came the invasion of the surgeon into the therapeutic field in diseases of the biliary passages. It was not long after he had laid down certain surgical laws or principles governing the treatment of cholelithiasis and cholecystitis, that he began to encroach upon the territory of the internist and lay claims based upon pathological and clinical evidence to the right to treat the chronic dyspeptic. One is struck with the immense amount of surgical literature touching upon gastric surgery, that has appeared in journals during the past five years, and one would draw the conclusion that the general surgeon here and elsewhere saw and operated upon not an inconsiderable number of cases each year. In looking into the reports of five representative hospitals in Philadelphia for the year 1905, I was amazed at the paltry number of cases of gastric ulcer or gastric carcinoma that were tabulated in the surgical tables. There were, all told, about 30 cases of gastric ulcer, 1 duodenal ulcer and 14 cases of carcinoma. My own experience in gastric surgery during the past year has been limited to 10 cases, including 2 perforating wounds of the stomach, 4 cases of gastric ulcer, 1 of atonic dilatation, and 3 cases of carcinoma. This array of figures would seem to cast a reflection either on the surgeon or the internist, or both. The surgeon might be held to account if either in technique and dexterity or in his selection of cases the results were not such as to warrant the internist entrusting his patients to the surgeon's care. The published statistics do not seem, however, to bear out this theory. The fault seems to lie

* Read before the Philadelphia Academy of Surgery, March 4, 1907.

rather with the internist, either in his failure to recognize the existence of an ulcer as the disturbing lesion in the chronic dyspeptic or on his unwillingness to admit and take advantage of the permanent relief to be obtained by properly chosen and properly executed surgical procedures. In the out-patient department of one hospital there were 176 cases of so-called chronic gastritis and not one case of gastric ulcer treated in the wards, while in another there were 321 cases in the out-patient department, and but 4 ulcer cases treated in the medical and surgical wards. With the absolute superficiality and disregard of the modern methods of accuracy, so prevalent in the average dispensary service, is it not likely that some cases of chronic ulcer are overlooked and perhaps a greater number of cases of carcinoma unrecognized in the operable stage. To a certain but lesser extent the same is probably true of cases seen in private practice. If in weighing the evidence the surgeon is found reprehensible, it may be because, in his earlier experience, he was less discerning in his selection of cases and advised operations in cases in which the findings and the results proved the impropriety of such measures. Nothing has done more to discredit the gastrojejunostomy than its performance in cases of atonic dilatation of the stomach without pyloric stenosis. The patients suffering from this lesion are often of the neurasthenic type; many have had movable kidneys, if they have not already been anchored for the time being by one of the innumerable methods, or symptoms referable to the appendix or ovary if these have not already been removed.

The first of the cases in the report was a man fifty-four years of age. He was a lithographer by profession but attained greater notoriety and reputation as a professional foot-racer. He had never been addicted to the excessive use of alcohol or tobacco, and until the onset of his present illness he did not know what it was to be sick. About two years prior to his admission to the University Hospital his appetite began to fail and he began to lose weight. He complained at times of a good deal of pain after eating, and about eighteen months later he began to vomit. His condition became more and more aggravated until, when first seen, he

vomited after every meal; he had constant pain in the epigastrium and his weight fell from 150 to 98 pounds. It was noted in his clinical record that, among other things, he had signs of arteriosclerosis; his urine contained neither albumin nor casts, the hæmoglobin was 60 per cent., red blood corpuscles 4,080,000, and white blood corpuscles 10,720. From the analysis of the stomach contents it was reported that Oppler Boas bacilli were present, that there was no free hydrochloric acid or lactic acid, and a total acidity of 58. The stomach was somewhat dilated but there was no palpable mass. Despite some of the negative findings, the age of the patient, his emaciation, the duration of his illness, the presence of Oppler Boas bacilli led us to view the case as one of carcinoma of the pylorus, probably too far advanced to admit of more than a palliative operation.

The operation was performed October 24, 1906, under morphin-ether anæsthesia, with the patient in the reverse Trendelenburg position. Through a 3½-inch incision a little to the right of the mid-line the stomach was exposed and an extensive area of induration discovered in the pyloric portion of the stomach. There were two palpable lymph nodes in the greater and three in the lesser curvature. There were, however, no adhesions to surrounding structures and the lesion, still regarded as carcinoma, seemed especially suitable for a partial gastrectomy. The four vessels, two in the lesser and two in the greater curvature, were ligated, enough of the gastrocolic and gastrohepatic omentum was tied off to include the enlarged lymph nodes from the pylorus to the Mikulicz-Hartmann line. Clamps were applied to the duodenum and the stomach, the intervening tissue divided with a cautery knife, the respective ends of the duodenum and stomach closed with two layers of sutures and an anastomosis effected with the Murphy button between the posterior wall of the stomach and the jejunum (no loop gastrojejunostomy).

As after many of these operations, the patient's convalescence was remarkably short and free from any discomfort. On the fifth day he was sitting in a chair and on the eleventh day he left the hospital. When last examined, three months after the operation, he had gained 34 pounds; he had been entirely free from pain and had vomited but twice, and then after an indiscretion in diet.

Report from the Laboratory of Surgical Pathology.—Specimen No. 1159. The specimen consists of the pyloric portion of the stomach, on the

external surface of which there were a few small glands about the size of a pea, and numerous fibrous adhesions. The ulcer occupied the region of the pyloric ring, and here the mucous membrane was thickened and eroded. Histological sections of tissues from the base of the ulcer failed to show any evidence of new growth. The mucous membrane was seen to be the seat of an inflammatory process; there was a decided infiltration of leucocytes, distention of the blood vessels, and some free blood in the tissues. The inflammatory action extended into the submucous coat where the blood vessels were quite distended and the tissues hyaline in appearance, resembling chronic granulation tissue. The muscular coats were involved to a lesser extent in the inflammatory process. In the numerous sections examined it was impossible to demonstrate any evidence of malignant infiltration.

Upon hearing the pathological diagnosis the questions arose in my mind as to whether it would have been possible to have made a correct clinical diagnosis in this case and whether if the benign nature of the lesion had been known at the time of the operation some other procedure should have been adopted. I think it would have been quite impossible from the naked-eye appearance of the tissue, either before or after its removal, to have distinguished it from a malignant lesion. The ulcer belonged to the indurated class which, according to Mayo, predominate over the non-indurated in the proportion of 85 to 15; the dimensions of the lesion, furthermore, suggested malignancy; and the enlarged lymph nodes which were present, though associated sometimes with ulcer, are more constant in carcinomatous conditions.

As to the clinical history and findings, the duration of the lesion—two years—should have pointed rather to ulcer, as the average duration of carcinoma before the surgeon is consulted has been estimated at nine months. Vomiting is complained of in the majority of cases of cancer, as it would be in a benign pyloric stenosis, and emaciation is common to both. It has been shown by analysis of a large series of cases that too much reliance should not be placed in the clinical and gastric analysis of the stomach contents. Thus in a series of 67 examinations of test meals reported by Graham (*Boston Medical and Surgical Journal*, vol. clv, No. 8), in only 32 was there free hydrochloric acid, in 42 lactic acid and in 13 both lactic and

hydrochloric acid. In 10 cases no blood was found and in but 27, about one-third, could a tumor be felt before the operation. The absence of free hydrochloric acid, lactic acid or blood, and the absence of tumor did not preclude the possibility of the lesion being of a malignant nature. The lesson to be learned from these statistics is the danger of placing too much reliance upon what might be called the refinements of laboratory diagnosis. How many cases does the surgeon see in which the question of operation has been fatally deferred because what are regarded as the positive diagnostic features of carcinoma are absent either singly or collectively?

As to the surgical procedure which was adopted in this case, I am disposed to think that even had I known at the time of the operation that I was dealing with an ulcer, I would have performed a partial gastrectomy. Of the three possible operations—gastroduodenostomy, gastrojejunostomy or gastrectomy—the choice would rest between the two last, as the extent and seat of the lesion would have rendered the first impracticable. As between the gastrojejunostomy and pylorectomy, preference should have been given to the latter because of the danger of malignant degeneration. Though complete cicatrization might have followed a gastrojejunostomy, while this process was going on, or even subsequently the lesion might have undergone malignant ulceration. Observations at the Mayo clinic have made out a very strong case in favor of the relation of cause and effect between ulcer and cancer, despite the skepticism of the clinician or clinical pathologist. Thus, quoting again from Graham (*loc cit.*), in over three-fourths of their cases (79.5 per cent.) the pathological evidence was good (54 per cent.) or fair (25.6 per cent.). Taking the clinical histories together with the pathological findings, in over half the cases the combined evidence pointed to an ulcer as the lesion, upon which a carcinoma had been engrafted. If, therefore, "ulcer is the great and fertile soil of cancer," a strong argument may be advanced in favor of what appears at first sight the more radical procedure. As to the relative mortality, I doubt whether in benign conditions the mortality

following the excision of the pyloric portion of the stomach will be much, if any, greater than after gastrojejunostomy, and the expectation of life should be greater because the favorite seat and a common predisposing cause of carcinoma has been removed. Rodman (*Journal of the American Medical Association*, 1906, vol. ii, p. 842) found but one death in a series of 31 pylorectomies for ulcer in the hands of five surgeons.

The second of the two cases included in this report was a gastric carcinoma. The patient was fifty years of age. According to her statement she had not observed any trouble with her digestion till seven months ago. She then began to complain of pain in the epigastrium and soon to vomit one or two hours after meals. The subsequent course of events, taken together with the presence of an easily palpable tumor in the pyloric region, and the gastric analysis, all suggested carcinoma of the pylorus. As the tumor was movable and the patient's general condition good, the case seemed quite favorable for a radical operation, and when the stomach was exposed at the operation this proved to be the case. The tumor had not spread beyond the pyloric portion of the stomach wall and had invaded but few lymph nodes. Accordingly, a partial gastrectomy was performed, the tissue removed including 1 inch of the duodenum, all that portion of the stomach up to the Mikulicz-Hartmann line, and the palpable lymph nodes. As in the first case, a gastrojejunostomy was effected with a Murphy button.

The recovery from the immediate effect of the operation was as satisfactory as one would have hoped for. At the end of a week the patient was sitting up in bed, had not vomited since the operation, and relished the food on her dietary. Two days later, however, she began to vomit and to complain of gastric distress; there was a little distention of the abdomen, but no rigidity or tenderness. The bowels were very loose and did not respond to any internal medication. The temperature meanwhile had been normal. Twelve days after the operation the patient began to fail very rapidly and on the fourteenth day she died.

An examination post mortem discovered almost a complete separation of the line of union between the stomach and jejunum. The Murphy button had passed on some two or three feet beyond the site of anastomosis. This result was quite unlooked for, and

it was the first unfortunate experience which I have had with the Murphy button, in so far as concerned the union of the apposed surfaces. Whether it was due to some mechanical defect in the button or to imperfect blood supply of that portion of the stomach at which the button was introduced, is a matter only of speculation. Had I not taken steps to prevent separation by the introduction at intervals of three or four interrupted sutures around the button I should have attributed the accident to an error of technic. In both of my cases the same technic was followed; the steps of the operation corresponded to the method of Billroth, in which the stump of the duodenum is completely closed and an independent gastrojejunostomy is performed. In neither case were there any technical difficulties; the pyloric end of the stomach was easily isolated, the gastric and superior pyloric arteries on the lesser curvature and the gastroduodenal and the inferior gastro-epiploic artery on the greater curvature ligated. Care was taken to avoid the middle colic, since occlusion of this vessel causes gangrene of the transverse colon. Clamps were applied to the stomach and duodenum, the intervening portion resected and the operation concluded in the conventional way.

The diagnosis of cancer of the stomach has been touched upon briefly already; suffice it to make two remarks with reference to the presence or absence of tumors. First, that on no account should there be any delay in recommending operation or exploration because of the absence of the tumor, since in a very considerable number in the early stage no tumor can be detected. Secondly, that the presence of a palpable tumor does not preclude the possibility of a radical operation. A small tumor near the pylorus on the anterior wall may be felt quite early in the course of the disease when it is still in the operable stage, whereas a large posterior cancerous mass may not be palpable until long after the time when it might have been removed.

The selection of the operation for gastric carcinoma depends upon whether a radical or palliative operation may be indicated. At first the operative treatment of gastric carcinoma consisted chiefly in palliative gastro-enterostomies, because cases were not seen in the curative stage. The surgeon's

experience with this operation has been most disappointing, both as to the mortality and as to the expectation of life. The Krönlein, Mikulicz, and Mayo statistics show that the average prolongation of life is only five months and that the mortality is from 15 to 33 per cent. At best there is but one chance in seven of getting over the operation, and then but five months more to live. Despite this wretched showing, the surgeon is quite justified in advising the operation when the patient is suffering intense pain, vomiting persistently and starving to death. I operated upon a patient of this description a little over a year ago; he was in a most forlorn condition, suffering intensely and emaciated to a degree. He survived the operation a little over a year, but in the meantime his gastric symptoms had been relieved, his vomiting ceased, he gained weight and one day he was carried off with an apoplectic seizure.

As compared with the discouraging results after gastroenterostomy, there is an increasingly brighter outlook for partial gastrectomy. The mortality is (Mayo) in some hands only 10 per cent., and 25 per cent. of the operative recoveries live more than three years. Of the three most common locations of carcinoma—the stomach, the breast and the uterus—the stomach from the operative standpoint is the most favorable. Eighty per cent. or more are in the pylorus; this portion of the stomach is easily removed and a rich vascular supply guarantees repair of the visceral wounds. Of still greater significance is the distribution of the lymph nodes. These are so arranged on the lesser and greater curvature that they all lie to the right of the Mikulicz-Hartmann line, and can be removed easily by including with the pyloric end of the stomach portions of the gastrohepatic and gastrocolic omentum. For this reason in the treatment of malignant disease the stomach, as compared with the uterus or breast, is a much more favorable organ for operative intervention.

TRANSACTIONS

OF THE

NEW YORK SURGICAL SOCIETY.

Stated Meeting, February 27, 1907.

The President, DR. GEORGE WOOLSEY, in the Chair.

GASTRO-ENTEROSTOMY WITH THE ROOSEVELT CLAMP.

DR. JOHN F. ERDMANN presented a man, fifty-two years old, a glazier by occupation, whose family history was unimportant. He had been under treatment at the Vanderbilt Clinic for some time for stomach trouble which consisted essentially of a feeling of heaviness coming on about two hours after each meal. He could usually be relieved by sodium bicarbonate.

In the early part of September, 1906, the patient was taken with one of these attacks, which, however, failed to subside, and steadily grew worse. In addition to his usual symptoms, attacks of vomiting developed, generally coming on about three hours after meals and sometimes during the night. By these attacks of vomiting, and also by lavage, his gastric pain was relieved. The patient gradually became weak, and lost about 25 pounds in three months. He had some aversion to meat, but his appetite was but slightly impaired. His bowels were somewhat constipated.

Physical examination: The patient was pale, but not cachectic. Heart and lungs negative. There was slight resistance over the stomach region. The pylorus was not palpable. The liver and spleen were negative. Urine negative. An examination of the stomach contents after a test breakfast gave the following results: Free hydrochloric acid, 36; total acidity, 60. No lactic acid; starch digestion, poor. The lower border of the stomach was at the navel; the upper border at its normal level. Motility of the stomach was much impaired. In the morning, on emptying the stomach, the organ contained about 1 pint of foul-smelling rancid food. A microscopical examination of the stomach washings

showed starch, some fat, mucus, little round cells, numerous bacteria.

The patient was operated on January 5, 1907. Upon exposure of the stomach and pylorus no evidences of malignancy were observed, but in the first portion of the duodenum a nodular mass, about the size of an egg, was found. This was located about 1 inch from the pylorus, and, on account of the dense adhesions, it was deemed inadvisable to remove it. A posterior gastro-enterostomy was thereupon done with the Roosevelt clamp. The patient made a slow but positive recovery from the operation, and up to the present time had gained about 20 pounds in weight.

Dr. Erdmann demonstrated the Roosevelt clamp. The instrument consists of a three-bladed clamp by means of which the tissues of the stomach and intestinal wall can be grasped and sutured with remarkable ease.

CHOLECYSTOTOMY FOR PANCREATITIS,

DR. JOHN F. ERDMANN presented a man, thirty-four years old, who was referred to him by Dr. Titus Bull on December 15, 1906. The history was that the patient was taken ill eight or nine weeks ago with sharp pain in the abdomen, followed by jaundice, pain in the back and some itching of the skin. The history stated that he had had similar attacks five years ago. He always had pain in his stomach, which was worse immediately after taking food. There was an occasional history of vomiting, and he stated that he had recently twice vomited dark, coffee-colored stuff. His present weight was 147 pounds, which represented a loss of 41 pounds since the previous spring.

Examination showed a patient 6 feet, 2 inches tall, markedly emaciated, with an extremely sensitive area covering the epigastric and both hypochondriac spaces. There was gastrectasia and gastroptosis.

Operation, December 18, 1906: Upon opening the abdomen, the stomach showed no evidences of malignancy or ulcer. The pylorus, gall-bladder and common duct were negative. Involving the pancreas there were two large masses, one in the head, about the size of a tangerine orange; the other in the tail, the size of a hen's egg. An attempt was made to remove a section of the large mass in the head, but it was accompanied by such profuse bleeding, with such difficulty in controlling it, that the

idea was abandoned. A cholecystotomy was thereupon done, and when the patient left the hospital, four weeks later, his general condition was excellent. Within seven weeks after the operation he had gained 35 pounds in weight, of which 30 were gained since he left the hospital. No calculus was found in the gall-bladder.

ABSCESS OF THE PANCREAS.

DR. GEORGE E. BREWER presented a woman, forty-eight years old, whose illness began with an attack of pain in the upper part of the abdomen, with fever and general prostration. She was admitted to the medical division of the Roosevelt Hospital, at which time she presented all the evidences of an epigastric peritonitis. The chief point of pain and tenderness was just to the left of the median line, midway between the ensiform and umbilicus. No diagnosis was made, but under expectant treatment the patient apparently improved. When she attempted to get out of bed, however, the pain and tenderness recurred, without any marked rise of temperature, and the patient was referred to the surgical division for exploratory operation.

On opening the abdomen, the stomach, the spleen and the transverse colon were found united by dense adhesions. The central portion of the pancreas seemed enlarged and indurated, and a needle introduced through the transverse mesocolon entered a cavity and withdrew creamy pus. The abscess was then opened by thrusting a pair of dressing forceps into the gland and withdrawing them partly open. The cavity was then explored with the finger, and was found to be limited to the pancreas. About 2 ounces of pus were evacuated. A large-sized drainage tube, about half an inch in diameter, was then introduced into the abscess cavity, and held there by single catgut suture. Gauze tape was packed around it to prevent any leakage of pus into the peritoneal cavity. The tube and gauze were allowed to pass downward along the posterior portion of the abdominal cavity, and were finally brought out at the lower angle of the abdominal wound. This allowed the transverse colon to fall into its normal position, and prevented any kinking by the tube.

For the first two days after the operation there was a very free discharge from the tube, after which it gradually ceased. While the external dressings were frequently changed, the tube was not disturbed for eight or ten days, when it was removed,

together with the gauze tape. The wound then promptly closed.

Practically, no reaction followed the operation, and the patient made an uninterrupted recovery. Upon examination, the pus showed a pure culture of para-typhoid bacillus.

DR. WOOLSEY said that in three cases of acute pancreatitis, where he had been called upon to operate, he had in each case expected an abscess, but in none of them did an abscess form. Nothing was done to the pancreas but to relieve the tension by a median abdominal incision, evacuation, irrigation, and drainage. The speaker said that Hahn had advised the same method of treatment, and had not found necrosis to follow.

TIC DOULOUREUX: SECTION OF THE SECOND AND THIRD DIVISIONS, WITH INTERPOSITION OF RUBBER TISSUE.

DR. BREWER presented a woman, fifty-four years old, who was admitted to the Roosevelt Hospital in October, 1904. She had suffered for eleven years with facial neuralgia, the pain being situated in the second and third divisions of the fifth nerve. At times the pain had been intense, and was associated with spasmodic contractions of the muscles. During the three months previous to her operation she had suffered intensely. She had great difficulty in taking food, and had lost sixteen pounds in weight.

Operation: The ganglion was exposed by the Hartley incision, the second and third divisions of the nerve were divided, and a folded piece of rubber tissue interposed between the divided ends. The patient made an uninterrupted recovery, and had not suffered a single twinge of pain since the operation, which was done two years and five months ago.

EPITHELIOMA OF THE LARYNX: LARYNGECTOMY.

DR. BREWER presented a man fifty-eight years old, who was admitted to the Roosevelt Hospital in August, 1905, suffering from a small epithelioma which was situated on the right vocal cord. Under ether anæsthesia a low tracheotomy was done, after which, with the patient in the Trendelenburg position, the cavity of the larynx was exposed by a median fissure, and the entire growth, together with both vocal cords and the surrounding mucous membrane and the submucous tissue, were completely removed down

to the cartilage. The laryngeal fissure was then closed by two or three sutures of catgut, and a tracheal tube allowed to remain in place. The tube was removed on the fourth or fifth day, and the patient was able to leave the hospital on the fourteenth day. He remained well for several months, but when he returned to the hospital, in March, 1906, there were evidences of a distinct recurrence. A total laryngectomy was thereupon advised, and was performed in two stages. The first operation consisted in a section of the trachea just below the cricoid, separation of the upper segment from the œsophagus, and stitching it to the cutaneous opening. Three weeks later the larynx was removed in the usual manner. Recovery was uneventful. It was now ten months since the operation, and there were no signs of a recurrence. The delay between the first and second stage of the operation was due to a broncho-pneumonia following the first division of the trachea.

DR. BREWER presented, also, a woman, thirty-one years old, who was admitted to the Roosevelt Hospital early in January, 1907. For eighteen months she had suffered from hoarseness, slight cough and aphonia. Laryngoscopic examination showed an infiltrating growth involving both vocal cords, the commissure, and extending well into the subglottic space. A fragment of the growth removed for microscopic examination showed nothing characteristic. Vigorous treatment with potassium iodide for three months was without result. Thyrotomy, with removal of a large section of the growth and the immediate examination of the frozen section likewise gave an uncertain result. A tracheotomy was then done, and the tissue sent to the laboratory for examination. The final report was that the growth was a characteristic and very cellular epithelioma. Two weeks from the date of the tracheotomy and thyrotomy, the larynx was removed under ether anæsthesia. Gluck's nasal feeding tube was introduced, and kept in place for sixteen days. The patient made an uneventful recovery.

DR. ERDMANN said that in one case of laryngectomy which he showed in connection with a series of these cases some years ago, the patient was still alive and well three and a half years after the operation. In that case, the patient wore a tracheotomy tube that was short and almost straight, with the idea that such a tube would be less apt to give rise to irritation than a long tube.

DR. WOOLSEY recalled the following case, that occurred at Roosevelt Hospital some years ago: A man, who was wearing a tracheotomy tube for laryngeal diphtheria, while apparently convalescing ten days or so after the operation, had a sudden hæmorrhage and was drowned in his own blood. At the autopsy it was found that the tracheotomy tube, which was fairly long and somewhat curved forward at its lower end, had ulcerated through the trachea into the innominate vein, thus causing a fatal hæmorrhage.

PRIMARY TYPHLITIS WITHOUT APPENDICITIS.

DR. CLARENCE A. MCWILLIAMS read a paper with the above title, for while see page 852.

DR. IRVING S. HAYNES said he could recall several cases of supposed appendicitis, where, after a careful examination, he had concluded that the involvement of the appendix was a secondary affair, and that the primary source of the trouble lay in the cæcum and colon. In those cases, he had advocated delaying operation, and the cases had recovered without it. In differentiating such cases from appendicitis he had usually found that they had a much higher initial temperature and a corresponding pulse rate, which was probably due to the rapid absorption of toxic products from the large inflamed areas in the cæcum and ascending colon. The abdominal pain, while on the right side, was more diffused than that usually observed in appendicitis, and could be located with less exactness, and on palpation, while the region of the appendix was tender, it was not more so than the whole length of the ascending colon. The speaker said that in one such case where he was induced to operate he found the conditions described by Dr. McWilliams. There were distinct evidences of congestion of the blood vessels in the cæcum, and some thickening of its walls. The appendix, which was about $1\frac{1}{2}$ inches long, less than $\frac{1}{8}$ inch in diameter and only slightly involved, was removed, and the case went on to recovery.

In concluding his remarks, Dr. Haynes said that while at times it might jeopardize the life of the patient by refraining from operation in our attempts to differentiate between typhlitis and appendicitis, still there were cases where the pathological changes were very pronounced in the cæcum and ascending colon, and less so in the appendix. Some of these typhlitis cases

demanded operative interference, while in others an operation could be safely withheld. However, in all doubtful cases it is better to operate.

DR. ERDMANN recalled to mind two cases, one of which was operated on about four years ago, and the other at the Gouverneur Hospital last April. The latter case was that of a bartender, thirty-four years old, who had long been a hard drinker. He gave a history of indigestion and some pain in the stomach, followed by a sudden, sharp attack of abdominal pain. He was kept under observation on the medical side for two days, and then developed evidences of peritonitis, with a markedly distended abdomen. Upon opening the abdomen on the right side, a perforation of the cæcum was discovered. There were no evidences of infiltration, such as are found in typhoidal, tubercular or malignant conditions. The man died of delirium tremens five days after the operation.

The other case referred to was that of a woman who had a tumor in the right side of the abdomen which was at first supposed to be connected with a floating kidney, and malignant in character. She gave an indefinite history of digestive disturbance. Upon opening the abdomen, a large mass was encountered. It apparently sprang from the cæcum and involved the entire ascending colon, and looked so formidable that an attempt to remove it was deemed unjustifiable. An anastomosis was thereupon done between the ileum and the sigmoid, the woman making an uneventful recovery. The operation was done about four years ago. The patient was still alive and well; she had gained about 40 pounds in weight, and the intra-abdominal mass had almost entirely disappeared. It was probably of inflammatory origin.

DR. BREWER said that some years ago he reported a case of complete spontaneous intussusception of the appendix into the cæcum. The latter was the seat of a distinct chronic inflammation, with a marked stricture just above the ileocæcal junction. The cæcum was much distended, and, upon opening it, there were a number of ulcerations such as Dr. McWilliams had described. The patient was operated on twice. At the first operation nothing was discovered but an acute typhlitis, and at the second operation the intussusception of the appendix was found.

DR. CHARLES N. DOWD said that he had been much puzzled during the past two years by some cases of retroperitoneal abscess occurring on the right side, and believed that an inflammation

extending from the cæcum or ascending colon would explain the etiology of a certain part of these cases. He had seen two which were apparently due to broken down hæmatomas. One he believed definitely to have extended from a tubercular intestine, since there was a fæcal fistula. Two others he thought were best explained on the hypothesis of an inflammation similar to that which Dr. McWilliams had referred to. Inflammations which were neither tubercular nor cancerous, certainly appear in other parts of the colon, particularly in the region of the sigmoid flexure, where they were sometimes the occasion of thickening and partial or complete obstruction, and it is fair to believe that a similar inflammation may exist in the cæcum, possibly more often than we have supposed, since appendicitis has been found to explain so much.

DR. JOHN A. HARTWELL said he had seen a case similar to the one referred to by Dr. Erdmann, where the conditions met with gave rise to the suspicion of a malignant growth. The patient was an Italian who was admitted to Bellevue Hospital in 1904 and treated on the medical side for some time for supposed fæcal impaction. Examination showed a distinct mass on the right side of the abdomen. An exploratory incision showed an ulcer, about the size of a silver quarter; it was situated on the anterior surface of the cæcum, and surrounded with marked infiltration and thickening of the entire wall of the gut. The growth was regarded as malignant, and a resection was done, and an anastomosis with the button. A subsequent pathological examination proved that the condition was one of simple inflammation, extending throughout the whole cæcum. On the sixth day after the operation, the patient had a severe coughing spell, and died. No autopsy was permitted.

DR. BREWER said that in the case just reported by Dr. Hartwell, the condition was originally regarded as one of fæcal impaction, and in several of Dr. McWilliams' cases reference was made to ulcerations due to possible pressure of the cæcum. As bearing on that point, Dr. Brewer raised the query whether any one had ever seen solid fæces in the cæcum? Personally, he had never seen it, and he thought we could practically exclude such a condition as fæcal impaction in the cæcum.

DR. WOOLSEY said that about two years ago he operated on a woman who gave all the local and general signs of an appen-

ditis, with abscess. Upon opening the abdomen, the appendix was found practically normal; but there was a great deal of thickening not only of the cæcum but higher up behind the ascending colon. Behind the cæcum there were multiple abscesses which extended up for some distance behind the ascending colon. The patient made a protracted convalescence, but finally recovered. Cases were occasionally met with, Dr. Woolsey said, in which the symptoms could not be attributed to the condition found in the appendix. Two or three years ago Dr. Blake read a paper before the Society in which he explained some of these cases on the ground of malposition of the appendix, congenital or acquired, dragging the cæcum out of position. Others of them might be explained in accordance with Dr. McWilliams' paper.

DR. MCWILLIAMS, in closing, said it was very difficult to explain the presence of these ulcerations in the cæcum. In most of the cases reported there were no hardened fæces in the cæcum; but there were a few cases on record, especially in patients well advanced in life, where that factor was referred to. In his own cases, the speaker said, there were no fæces whatever in the cæcum. The pathology of the cæcum was not well understood. Possibly, its dependent position might have something to do with it, and foreign bodies projected into it may cause abrasions of the mucous membrane. It was just as difficult to explain analogous ulcerations of the sigmoid, which were very frequent.

In his paper, Dr. McWilliams said, he confined himself to inflammatory conditions limited to the cæcum, and did not intend to include cases of general colitis. A lengthy discussion was opened by Dieulafoy before the Académie de Médecine (reported in the *Revue de Chir.*, 1906, Nos. vii-viii, p. 186 and 301) appertaining to the relation between mucomembranous typhlocolitis and appendicitis.

It would be no easy matter to differentiate peritonitis due to inflammation involving the cæcum and the ascending colon from peritonitis due to an appendicitis. In doubtful cases, an operation should be resorted to.

LIGATURE OF THE INNOMINATE ARTERY.

DR. B. FARQUHAR CURTIS reported this case and showed the specimen. The patient was a man, fifty-nine years old, a native of Germany and a carpenter by occupation. He was admitted

to St. Luke's Hospital on January 4, 1907, with an aneurism of the right subclavian artery.

Operation, January 11, 1907: The manubrium was split to a point below the second rib and the two halves forcibly separated a distance of $1\frac{1}{2}$ inches. The innominate artery was exposed and ligated with No. 4 chromacized catgut, two strands being laid side by side and tied separately 1 inch from the origin of the vessel. Another double ligature of the same material was placed $\frac{1}{2}$ inch beyond the first distally, and the two threads tied together. The divided bone was then sutured with chromic catgut. No drain was used.

All pulsation ceased in the aneurism, the arm and the right carotid immediately after the operation. Twenty-four hours later, pulsation reappeared in the right external carotid. Patient developed a bronchopneumonia, and died four days after operation.

Autopsy showed an aseptic wound. The persistent cough had caused the bone sutures to yield. Both ligatures lay upon the innominate artery, but the proximal one had been driven forward to the distal one by the forcible impulse of the arterial pulsation. The specimen showed the heart, great vessels, and aneurismal sac. A section through the ligatures and vessel wall at the point of ligation shows the vessel folded in longitudinal pleats, the inner surfaces in contact, the internal coat not ruptured. A clot filled the distal part of the innominate artery, the subclavian, and the aneurismal sac. The origin of the common carotid was also filled with clot, but that vessel was clear at its bifurcation. There was no clot on the cardiac side of the ligature. The vessel wall at the point where the first ligature was tied, and over the space travelled by it in slipping forward, showed no alteration. There was moderate atheroma. The sac was about 5 inches long, 4 inches in diameter, involving the first, second and third parts of the subclavian. It had caused complete absorption of the anterior part of the first rib and the scalenus anticus muscle could be seen inserted into the sac wall where the bone had disappeared. The brachial plexus was stretched tightly over the upper part of the sac. Its lower part encroached upon the apex of the thoracic cavity, displacing the pleura and lung. Considerable amounts of blood clot were found in the mediastinum, having extended downward from the seat of operation. The lung showed a purulent bronchitis and bronchopneumonia.

TRANSACTIONS

OF THE

PHILADELPHIA ACADEMY OF SURGERY.

Stated Meeting, held March 4, 1907.

The President, DR. JOHN B. ROBERTS, in the Chair.

FRACTURE OF ANATOMICAL NECK OF THE HUMERUS, WITH DISLOCATION.

DR. W. W. KEEN reported this case with exhibition of specimen and skiagraphs. See page 938.

FRACTURE OF THE GREATER TUBEROSITY OF THE HUMERUS.

DR. W. W. KEEN reported this case, showing numerous skiagraphs and plates of this and similar cases. See page 938.

DR. GWILYM G. DAVIS mentioned a case of fracture of the anatomical neck of the humerus which he saw many years ago when a resident in Dr. Morton's service. The patient was an old person who had a fracture through the anatomical neck, with dislocation of the fragment into the axilla, under the pectoral muscle. An incision was made along the border of this muscle and through this the fragment was removed.

DR. JAMES K. YOUNG has seen recently in consultation one case of fracture of the greater tuberosity of the humerus, the X-ray of which he exhibited, in which the diagnosis was made by him from the clinical symptoms. It was an illustration of the point mentioned by Dr. Keen regarding the manner in which this fracture is received, the patient falling with the arm high in the air. A second feature of this case, and a point not mentioned by Dr. Keen, was the peculiar position of the resulting ecchymosis, which followed the biceps tendon and appeared down the front of the arm almost to the elbow. The disability following the acci-

dent was attributed by Dr. Young to injury of circumflex nerve.

DR. GEORGE G. ROSS said that at the German Hospital they see a number of fractures of the anatomical neck of the humerus. They treat them by applying ordinary dressings without resort to operative procedures. This fracture is not uncommon and the ultimate results are usually good. One man of forty-five years received the fracture three weeks ago, is now having passive motion applied, and can bring the arm almost to a right angle.

DR. LEE said he had been three of the cases which Dr. Montgomery skiagraphed. He also saw Dr. Keen's case when the man first came to the receiving ward and also after reduction. Crepitus persisted and the provisional diagnosis was fracture of the coracoid process.

DR. KEEN, in closing, said in reference to fracture of the anatomical neck, that operation is not needed if the fracture extend outside the capsule, unless the raw surfaces of the bone are reversed and cannot be brought in contact, or unless the separation be entirely intracapsular and the fragment therefore be deprived of all blood supply. There was no hope of union in his case, without operation, as the fragment was displaced at a distance and was also reversed. He did not agree with Dr. Ross that the accident is a common one. Dr. Young's statement regarding the ecchymosis in his case is an interesting observation. In Dr. Keen's case there was no ecchymosis present, but when present its extension down the biceps would be of diagnostic value.

FRACTURE OF FEMUR AND PELVIS.

DR. ROBERT G. LE CONTE presented a boy of eight who on January 1, 1907, was caught on the fender of a trolley car and rolled along the ground, it being uncertain as to how much weight came upon him. He sustained a fracture of the upper third of the left femur, a fracture through the left ilium just to the outer side of the sacro-iliac joint (Fig. 1), a wound of the perineum extending to but not opening the membranous urethra, a scalp wound and general bruises over the entire body. Now, about ten weeks after the injury, the boy is able to walk well, although he does so with some limp. As the anterior and posterior spines of the ilium of the left side are lower than those on the right, it has not been determined how much shortening, if any exists in the left leg.

GUNSHOT FRACTURES OF FEMUR AND FOREARM.

DR. LE CONTE presented a man of twenty-six who was shot on September 1, 1906, with a 38-calibre revolver, in the lower part of the left thigh and also in the left forearm near its middle. The thigh was fractured very obliquely; the line of fracture ran from below upward and from the outer anterior aspect inward for a distance of nearly 3 inches. The long, thin upper fragment had penetrated the knee joint and interfered markedly with motion. Four weeks ago an incision was made on the outer aspect of the thigh and $1\frac{1}{2}$ inches of the spike-like portion of the upper fragment was removed sub-periosteally without opening the knee joint. There was firm union of the fragments. The two skiagraphs (Figs. 2 and 3), before and after operation, show very well the portion of bone removed. Motion at the knee joint has now increased to a little over a right angle and he walks without a limp.

The bullet which passed through the forearm fractured the radius into three pieces, the middle piece or fragment being $2\frac{1}{2}$ inches long and having been driven into the muscles on the radial side of the forearm. The lower fragment had been driven toward the ulna and had become united to it. There was entire absence of pronation and supination, and flexion and extension at the wrist joint was almost gone. From the skiagraph (Fig. 4), which shows the position of the fragments accurately, and also small particles of lead embedded in the muscles, it would look as if the fragments were separated by the interposition of muscular tissue and that no union had taken place.

A long dorsal incision was made the same day that the femur was operated upon, and on exposing the fragments of the radius it was found that the upper and middle fragments were firmly united, while the lower one had grown fast to the ulna. This latter fragment was separated from the ulna and brought into line with the rest of the radius, drilled and wired to the middle fragment (Fig. 5). Now he has nearly 50 per cent. of pronation and supination and quite 50 per cent. of flexion and extension at the wrist.

COMPOUND FRACTURE OF RADIUS AND ULNA.

DR. LE CONTE presented, also, a man aged thirty-two, who sixteen months ago had his right forearm caught in a bread mixer,

FIG. 1.



CASE I.—Showing fracture of the left thigh and left ilium.

FIG. 2.



CASE II.—Gunshot fracture of the left femur, before operation.

FIG. 3.



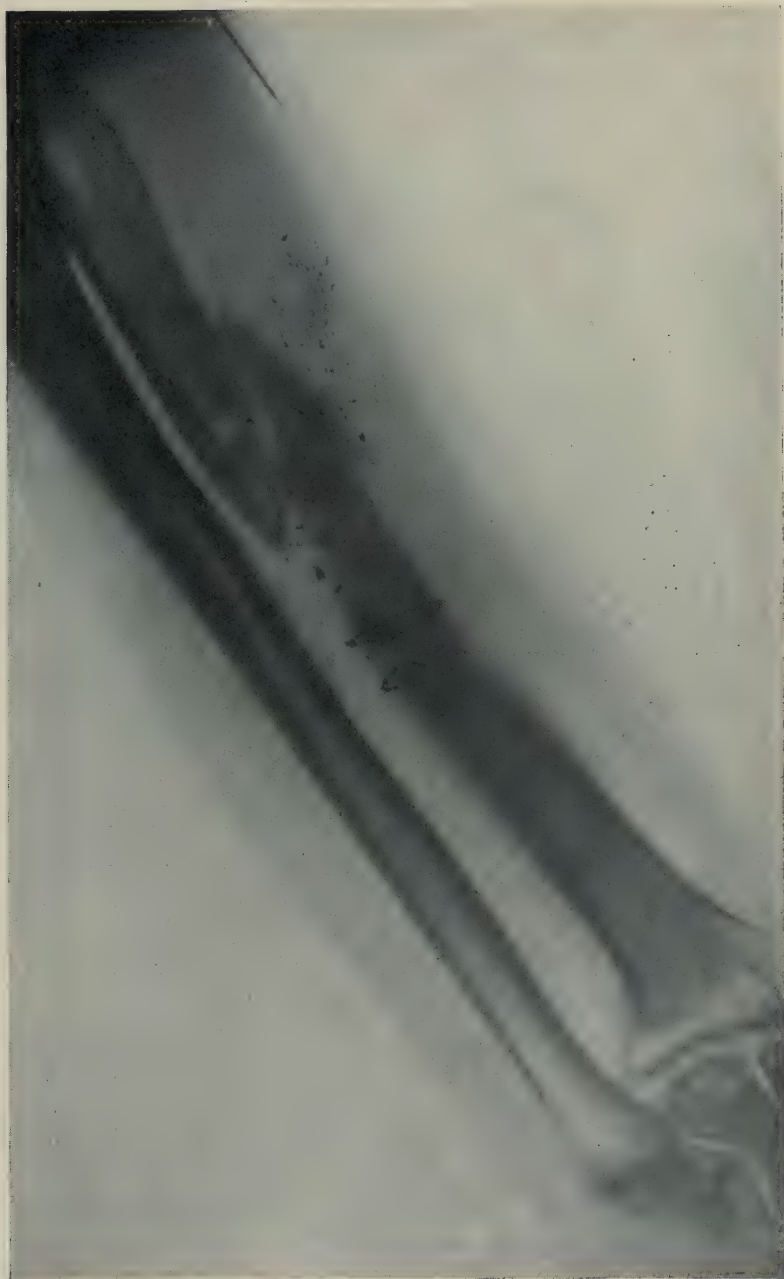
CASE II.—The same after removal of the spike-like process.

FIG. 4.



CASE II.—Gunshot fracture of left forearm, before operation.

FIG. 5.



CASE II.—The same after wiring.

FIG. 6.



CASE III.—Deformity following compound fracture of the radius and ulna.

FIG. 7.



CASE III.—The same after correction.

and sustained a compound fracture of the radius and ulna about $1\frac{1}{2}$ inches above the wrist joint, with a long oblique fracture of the external condyle of the humerus. As a result of this injury the hand was deflected to the ulnar side, between 45 and 50 degrees, rendering it practically useless (Fig. 6). At the elbow joint the motion was very good, although the deformity was marked. Two and a half weeks ago an incision was made on the dorsum of the radius and a second over the outer aspect of the ulna. With considerable difficulty the lower fragments of the radius and ulna were loosened from their bed of fibrous tissue and brought into a straight line, drilled and wired (Fig. 7). It is too early yet to foretell the degree of usefulness which will return to the hand.

DR. RICHARD H. HARTE, speaking of the results obtained in the forearm first described, said that he saw the operation and at first it appeared impossible to obtain any satisfactory result. There seemed to be multiple fractures and the wound appeared to contain a particle of lead. It seemed as though resection of the fragment would be necessary, but a good result was obtained without.

The other patient was shown by Dr. Harte to the students at the University. Deformity was extreme, being greater than he had ever before seen at the lower end of the radius. The part looked much as though it was the site of an enormous osteosarcoma. A great deal of exuberant callus was removed and the indications are that good results will be secured.

DR. GEORGE G. ROSS mentioned a case of fracture of the pelvis in a man caught between a swinging crane and a pillar, and rolled around the latter. In addition to the fracture there was rupture of the posterior wall of the bladder. A catheter in the bladder discharged only blood for twenty-four hours and then bloody urine. During one day 96 ounces were passed. After four or five days the man was operated upon. The ascending ramus of the pubis was fractured on both sides and the broken ends protruded into the bladder. It was impossible to reduce them. The man died of sepsis a few days later.

PARTIAL GASTRECTOMY WITH REPORT OF TWO CASES.

DR. CHARLES H. FRAZIER read a paper with the above title, for which see page 950.

DR. JOHN B. DEAVER said he was not surprised at Dr. Frazier's statement regarding the comparatively few cases of carcinoma recognized in the medical dispensaries. As long as dispensaries are run in the slipshod manner they now are, there will be few cases referred from them. It is disappointing to think of the way these dispensaries are conducted, the patients being rushed through, this one ordered prescription No. 4, that one No. 6, and so on. At the German Hospital, Dr. Deaver diagnoses a fair number of cases of ulcer and cancer of the stomach which are sent to him, and no doubt his medical colleagues could do the same under proper circumstances.

He does not agree with Dr. Frazier as to the general value of the Murphy button. He has seen mishaps with it in cases of enterostomy, in spite of the fact that the nurse in charge was always careful to see that mechanically the buttons were all right. He has long since discontinued its use, which can well be done when there are still the various forceps and the needle and thread. The results in stomach resections in Dr. Deaver's hands are good.

What is more needed at the present moment than anything else is that either an earlier diagnosis be made, or, in the light of suspicious symptoms, abdominal incision recommended.

DR. W. W. KEEN, in speaking of the findings of the pathologist in Dr. Frazier's first case, said that when there was a difference between the pathologist's findings and the clinical history he was inclined to be guided by the latter in preference to the former, for the pathologist as well as the clinician makes mistakes. In Dr. Frazier's case where the microscope showed no carcinoma, in the speaker's opinion the clinical history pointed to the fact that carcinoma would have developed, and he showed good judgment in doing a pylorotomy.

In carcinoma of the stomach operation is often too long delayed. Adhesions often prohibit operation in cases where there is a palpable tumor. Dr. Frazier was fortunate in his first case in not finding adhesions so extensive as to prevent removal. In general, if in three or four months a gastric disorder becomes no better under careful treatment, abdominal section should be made. In this way carcinoma will be detected early before there is a palpable tumor, and relatively good results will be secured.

DR. JOHN H. GIBBON, in speaking of the differential diagnosis between indurated ulcer and carcinoma of the stomach, said

there is nothing more difficult unless it is deciding whether to do a gastro-enterostomy when there is an ulcer at the pylorus. There are no rules for these cases. In a personal case reported several years ago there was a palpable mass and he expected to find a cancer. He found a mass in the stomach and did a gastro-enterostomy, intending to do later a resection. The woman at once improved and to-day is well, the lesion evidently being ulcer instead of a cancer. Another case was exactly the opposite, cancer being present when the diagnosis of indurated ulcer had been made. The case, however, was inoperable and the patient died, there being cancer of the suprarenals also. Moynihan states that differentiating points are hardness and glandular involvement in cancer and more extensive adhesions in ulcers.

Dr. Gibbon does not agree with Dr. Frazier that partial gastrectomy is no more dangerous than posterior gastro-enterostomy; hence the importance of differentiating between ulcer and carcinoma. He also has had trouble with the Murphy button, particularly in a case of end-to-end anastomosis of the large bowel in which ulceration due to the button was followed by abscess behind the colon and death in five weeks. Murphy is now using an oblong button with the intestinal side larger and heavier than the other in order to prevent the accidents caused by the older form; but this is not appreciated by many, especially by foreign surgeons. Still, trouble may occur with the new pattern.

A palpable mass in the stomach does not always mean carcinoma, as shown by the presence of the ulcer in his case. Robson has shown that where there is a palpable mass one is justified in operating, although under such circumstances one feels that he is operating too late. Dr. Gibbon agrees with Dr. Frazier that in cases of cancer partial gastrectomy is preferable to posterior gastro-enterostomy. Although the latter gives great relief for a few weeks, improvement lasts only a short time.

DR. GWILYM G. DAVIS said the referring of but few cases of early gastric cancer is not entirely the fault of the out-patient medical men, but is due partly to force of circumstances. Typhoid fever is so rife that admission to other cases is denied and hence chronic stomach affections that should be carefully studied have to be turned away. Dr. Davis agrees with those who eschew the use of the Murphy button, as he came to grief with its employment some time ago in an end-to-end anastomosis of the small intestine.

If in a stomach lesion he believes he is dealing with cancer a radical operation is performed; if the lesion is regarded as an ulcer, he performs posterior gastro-enterostomy as being less dangerous than the former.

DR. FRAZIER, in closing, mentioned a case somewhat similar to that of Dr. Gibbon's, as an example of the improvement and apparent restoration of health which may follow gastro-enterostomies. The patient was operated upon about four years ago for a tumor at the pyloric end of the stomach, which was believed to be carcinoma. He was very much emaciated at the time, owing chiefly to obstructive symptoms. A posterior gastro-enterostomy was done and the patient rapidly gained in strength and weight, and was apparently wholly restored to health; consequently the lesion is believed to have been an ulcer, although there was a distinct mass which was quite palpable before the operation.

As to the terms partial gastrectomy and pylorectomy, he thought that the term pylorectomy might now be employed to include not only resection of the pylorus, but resection of the pyloric portion of the stomach, that is, up to the Hartmann-Mikulicz line.

The unfortunate results in the second case of gastrectomy may not have been due to the use of a Murphy button. It is only fair to say that the button used in this particular case was found upon its removal at the autopsy to have been imperfect in its construction and mechanism. Whether or not this defect was responsible for the accident it is impossible to say, although perhaps it would be only fair to give the button the benefit of the doubt.

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